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Dynamics and Cost of Insurgency: the Maoist Insurgency in Nepal

by

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ABSTRACT

Nepal faced a ten year long Maoist insurgency problem when the Communist Party of Nepal, CPN (Maoist) declared war in 1996 by rejecting the fundamental premises of Nepal's constitutional monarchy and parliamentary system established in 1990 and ended with a comprehensive peace agreement in 2006. A decade-long insurgency and counterinsurgency claimed many lives, destruction of infrastructure, internally displacement of people, and crossing over to India. Insurgency compelled to bear direct, indirect and hidden cost to the nation.

The purpose of this study is to develop a computer simulation model to yield valuable insights into dynamics of insurgency evolution, determine insurgency mitigating conditions and estimate cost of the insurgency. The main hypothesis of this research is that the lack of understanding of the dynamics of insurgency development and mitigation has contributed to the cost of the conflict. The study aims to apply system Dynamics (SD) methodology with conflict transformation theory to examine the development, management and cost of conflict.

The fundamental proposition of this study is that an insurgency must be analyzed within a system in which all behavior is produced related to the insurgency. The utility of the model designed in this study is not limited to insurgency in Nepal, rather the implication of understanding and analyzing the war on terrorism as a global insurgency. It indicates a shift in the main emphasis for the conduct of the insurgency or counterinsurgency activities. The primary emphasis must shift to, and remain on the population. Instead of applying the majority of the resources to answering the insurgency with the military response, the insurgency analysis suggests that focusing on the insurgent's support base and resources is a more effective method of defeating them. Achieving popular support strengthens the security force ability to combat the insurgent while at the same time drain the insurgent's ability to commit violent incident.

The study finds that fully reliance on armed solution might not be a good answer for any conflict. The cost of armed conflict might always be greater than its benefit. The core insight gained from this study, the most powerful instrument that shapes the future of peace and security, is the self-examination of costs and dynamics of the insurgency. The major recommendations of this study on the basis of findings are:

First, the insurgency should not be thought of in military terms only, but it should be scrutinized in light of the national strategy and the implementation of state capacity elements. Military,

diplomatic, socio-economic, governance and legislative efforts all must be synchronized and united toward achieving the common principal objective, the defeat of the insurgent and its underlying causes. Addressing transitional security requires improving the elements of national power including democracy and governance.

Second, the effort for the state must be to gain popular support, which gives legitimacy to the security force operation. It provides the necessary intelligence to locate the insurgent members and removes the recruitment base from the potential insurgent. Insurgents do also rely on public support, without public support to them; the resources needed for their survival and actions are no longer available.

Third, the security force must limit the use of direct action against the insurgent without having good intelligence so as to minimize innocent casualties. The state should focus on moderating their recruitment base by improving state capacity elements such as the governance, employment, legitimacy and the economy.

Fourth, the short and mid-range strategies should be designed to disrupt and control the insurgency while the long-range strategy should focus on ideological support to the insurgent and the culture of violence.

Fifth, Continuous sincere effort must move toward socio-economic-political reform in post-conflict situation to prevent the country being trapped into further conflict.

Sixth, Insurgency, organized crimes and insecurity, should not be limited to the burden of the country concerned, rather recognize the problem of the international community as a whole. The state should emphasize gaining support of the international community for moral and resource support.

Seventh, cost of the conflict tends to be incorrectly perceived and underestimated. Economic losses have long term impacts on the economy, therefore, should be given proper attention and dedicated policies should be sought to minimize the adverse economic effects.

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List of Abbreviations

AFP	= Armed Forced Police
CA	= Constituent Assembly
CPA	= Comprehensive Peace Agreement
CPN (Maoist)	= Communist Party of Nepal (Maoist)
GDP	= Gross Domestic Product
R&D	= Research and Development
SD	= System Dynamics
SF	= Security Force
UNMIN	= United Nations Mission in Nepal

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Chapter One: Introduction

Conflict is a dispute between two opposing groups, external or internal to the country. An example of an external dispute is state-to-state conflict, which is on the decline globally. Internal conflicts have resulted in three times as many casualties as wars between states since World War II. Internal conflict can also be classified into two categories as conflicts against the state (i.e. civil war) and the people-to-people conflict (i.e. ethnic conflict) (Fearon and Laitin, 2003 cited on Ghani and Iyer, 2010). More than 70 civil wars have happened around the world since 1945, claiming around 20 million deaths and displacing more than 67 million people (Collier and Sambanis, 2005 cited in Do and Iyer, 2009). Insurgency can be defined as the political warfare with low-intensity violence intending to change public policies and possibly to overthrow the current regime. Insurgency has become a strategically significant form of asymmetric conflict over the past century (Marks, 2003). It has become an effective alternative to conventional warfare due to better communication with increased propaganda from both sides, loss of lives, economic losses, destruction of infrastructure, and increased acceptance of violence (Collier et al., 2003; Anderson, 2006).

Nepal faced a ten year long Maoist insurgency problem when the Communist Party of Nepal, CPN (Maoist) declared war in 1996 by rejecting the fundamental premises of Nepal's constitutional monarchy, and parliamentary system established in 1990 by the popular movement called Jan Andolan I (Ra and Sing, 2005; Do and Iyer, 2009). A decade-long insurgency and counterinsurgency claimed more than 16000 lives, 400000 families displaced internally, and thousands were crossing over to India. Costs of insurgency include the destruction of more than 3800 police stations and government offices. The opportunity cost of lost output counted more than 3 percent of current GDP (Upreti, 2006; Pradhan 2009; Shakya, 2009; World Bank, 2010).

Why was Nepal trapped into violent conflict? There has been much academic work trying to examine causes and consequences of conflict in Nepal. Simkhada and Oliva (2005) have published a comprehensively annotated bibliography comprising 34 books and monographs, 45 academic articles, 92 reports, research studies and working papers, and nine miscellaneous items.

They applied different methods and techniques for understanding and analyzing causes and consequences of conflict. Some explained social inequality, exclusion of a large section of society from the fabrication of political power and sharing of resources as the underlying causes of conflict. Some other described the rise of Maoist and its violent campaign within the historical-structural conditions, religion-culture of cast-based discrimination, post-1990 constitutional and political practices as well as regional and international context. Poverty and unemployment have been perceived as the important contributing factors of violent conflict in Nepal. Similarly, for some other the feudal beneficiaries that have monopolized political power for centuries are to blame for insurgency uprising in Nepal (Simkhada and Oliva, 2005). However, none of the studies used a System Dynamics approach to examining insurgency dynamics in Nepal.

The purpose of this study is to develop a computer simulation model to: (1) yield valuable insights into dynamics of insurgency evolution (2) determine under which conditions insurgencies might be mitigated and (3) estimate to what extent insurgency affects economic performance of the country.

While not analyzing underlying reasons for the conflict, my main hypothesis of this research is that the lack of understanding of the dynamics of insurgency development and mitigation has contributed to the cost of the conflict. According to Herbert Simon human beings' judgment is governed by "bounded rationality" cannot capture the entire dynamics of conflict and peace (1983 p19 cited in Dahal, 2010). For this reason, it also seems worthwhile to examine why conflict in Nepal has not disappeared entirely even after "Comprehensive Peace Agreement" (CPA) of November 21, 2006, confirmed by the government and the Maoist. The Constituent Assembly (CA) election of April 10, 2008 has further strengthened the tendency of conflict as it has transformed the state-centric conflict into society-centric. It has created a new bargaining environment beyond the mandate of CPA (Dahal, 2010). In particular, this study concentrates on dynamics of Maoist insurgency and its associated cost in Nepal.

The forces at play during and after conflict are complex and do not come under the scope of any single academic discipline. Hence, the study on conflict is interdisciplinary; economists, sociologists, political scientists, military theorists, member of civil society and relief

organization, and operation research analysts have all made contributions to understanding conflict and its impact (Richardson, 2004). In this research, System Dynamics approach is applied in studying the interconnected cause and effect relationships of conflict. System dynamics modeling allows the researcher to analyze complex system from a cause-and-effect perspective, rather than from a statistical standpoint. System dynamics also provide flexibility to the researcher to utilize both conceptual understandings, as well as empirical data (Gil et al., 2005; Choucri et al. 2006).

Therefore, this study aims to apply system Dynamics (SD) methodology with conflict transformation theory to examine the development, management and cost of conflict. The fundamental proposition of this study is that an insurgency must be analyzed within a system in which all behavior is produced related to the insurgency. In line with this premise, efforts are made to determine variables included in the system and to analyze their behavior and their interaction with one another. In doing so, effort is made to; (1) build a generic model of the dynamics of insurgency evolution (2) simulate insurgency and economic performance scenarios in terms of GDP growth and (3) test policies to mitigate insurgency.

The entire thesis is organized in 7 chapters. Literatures about conflict transformation and system dynamics have been reviewed in Chapter 2. Problem definition and hypothesis described, and reference mode formulated in Chapter 3. In Chapter 4, the model is explained. Model validation and the results are presented in Chapter 5. The discussion continues in Chapter 6 about possible scenarios. The study concludes and presents ideas for future research in Chapter 7.

Chapter Two: Literature Review

2.1 Introduction

This chapter presents an overview of the literature relevant to developing a model capturing interlinked cause and effect relationships of conflict. System dynamics approach has applied to examine causes and consequences of conflict in Nepal.

2.2 System Dynamics Literature

The idea of system dynamics modeling approach as a method of analyzing, modeling and simulating physical and social system, Jay Forrester and his colleagues have first proposed at the Massachusetts Institutes of Technology (MIT) in 1961. He has developed original ideas by applying concepts from feedback control theory, decision-making processes and experimental approach to study of industrial systems (Ford, 2010, Forrester, 1961). According to Forrester (1961) information feedback characteristics of industrial activities shows, how organizational structure changes (in policies) and time delay (in decisions and actions) interact to affect the success of the enterprise. Industrial dynamics provides ‘a single framework for integrating the functional areas of management- marketing, production, accounting, R&D, and capital investment’ (Forester, 1961:13). He further expanded the scope of system dynamics applying these ideas with his book Urban Dynamics in 1969. Urban dynamics explained the rapid population growth and subsequent decline seen in cities (Ford, 2010). Later the idea of Forrester has been used to capture the dynamic relationship of energy and the economic growth and the environmental implications and supply-chain management. Similarly, several scholars have used the ideas to analyze and model policies for nation building, software development, state stability, insurgency, and terrorism (Stermann, 2000; Richardson, 2004; Choucri et al. 2006; and Stroh, 2009).

Recently many researchers have applied the system dynamics approach for understanding and analyzing conflict, insurgency, terrorism, and war and security. Crane (2009) has used system dynamics approaches to characterize the strengths and weakness of the Democratic Republic of

Congo- an African Country experienced a number of struggles and conflict. Richardson (2004) describes the viability of applying systems dynamics modeling techniques to simulate the establishment of public order and safety in a post-conflict reconstruction operation in Iraq. He has identified the number of dissatisfied person with the occupation, and the rates of restored critical infrastructures have the highest impact on how long it takes to establish security.

In an article Choucri et al. (2006:3) argue that a 'state is stable for the extent that its resilience (capabilities) is higher than the load (or pressures) exerted upon it.' They applied system dynamics model to understand the nature and dynamics of insurgency and core feature of state resilience (capacity) to withstand loads produced by the insurgency. Supinajaroen (2011) applied system dynamics approach to examining maritime sovereign disputes in the South China Sea (SCS) and potential benefit and cost of war for China. Gil et al. (2005) used a System Dynamics model to capture the causal relationships of terrorist activities of Middle Eastern groups against the United States based on their ideological drivers and the result of U.S. policies that create dynamics and affect performance and outcomes.

Sokolowski and Banks (2007) used SD model to understand the nature of insurgencies and determine strategies for mitigating their effects. Their study used the system dynamics model to develop a population dynamics, mathematical representation of insurgencies and the factors that control the flow of people in and out of insurgency behavior. Similarly, Anderson (2007) demonstrates potentiality for using system dynamics in analyzing urban insurgencies. In another study, he used system dynamics model for the counterinsurgency strategy including the effects of intelligence, public security, popular support and insurgent experience (Anderson, 2011).

2.3 Conflict Literature

Adam Curle, one of the earliest Quaker conciliator- described stage of progression of conflict to peaceful resolution as; (1) Latent conflict and education, (2) Overt Conflict and Confrontation, (3) Negotiation and Sustainable Peace. Awareness on conflict increases through education, confrontation and negotiation. The balance of power and peace relationship increase in the later period (cited in Shakya, 2009). In Nepal, the popular movement (Jana Andolan) in 1990 brought significant changes in the political and social sphere as well as expands people's expectation

from the regime. Political awareness, increased access to formal/non-formal education, and media brought much consciousness on people's lives. Scholars argued that the failure to meet people's expectation generate room for Maoist insurgency in Nepal (Khadka, 1993).

The Maoist insurgency did not happen and bloomed suddenly in 1996. It was the product of continuous ignorance of the need of the lower segments of Nepali society especially in difficult terrain of rural area along with weak governance, ineffective resistance to Maoist impact, and state failure in addressing issues of caste, ethnicity, and language. Similarly, government's inability to resolve the political dispute within the jurisdiction of directive principles of the constitution is also the cause of the insurgency in Nepal (Marks, 2003; Letch, 2005).

Initially, Maoist started opposing the regime with a small number of insurgents in the rural part of the country. In response, the government has launched counterinsurgency operation in the name of Operation Romeo and Kilo Sera II. During the operation, security force used excessive coercive acts (criminalized, imprisoned, tortured, humiliated innocent people) in the name of controlling insurgency. As a result, small movements swept across the country like wildfire. The suppression continued, and violence escalated from both warring sides. On the other hand, it raised many issues of pervasive structural violence (Shakya, 2009). In the negotiation stage, both conflicting parties realized need for compromise and cooperation that can lead to agreement for restructuring the relationship and increased justice. There were many peace talks and mediations in Nepal. First one had conducted in July 2001, second in March 2003; finally, the state and the Maoist signed the Comprehensive Peace Agreement (CPA) in November 21, 2006. After the CPA, the election of Constitution Assembly has accomplished successfully in April 10, 2008. On the other hand, there is persistence of trauma, hatred, revenge, and continuation of violent armed groups in the society (Shakya, 2009). The hope of sustainable peace has threatened because of the dissolution of the CPA without delivering a new constitution to the country.

In the context of Nepal, Burton's human needs theory could be, according to Shakya (2009), appropriate theory to examine major cause of armed conflict. These are social exclusion and disruption of human needs of identity (ethnic, cultural, religious, language), dignity, security, and the community (Shakya, 2009). However, Acharya (2009) found no evidence that political and economic grievances linked to the rate of political violence. He also found no evidence that

class, caste or ethnic grievances were at the root of the Maoist conflict. Rather, probably many of the villagers who joined the insurgency did so out of necessity associated with their safety (i.e. they would have a higher probability of killing if they did not join) or for personal economic reasons such as the desire for food, shelter and clothing. The intensity of violence was greatest in districts with low road density especially, in the Midwestern districts (Acharya, 2009). In particular, Fearon and Laitin (2003) claim that the relationship between poverty and civil war is strong due to weak state capability in poor countries. They also find that geographical conditions that favor insurgency play an important role in the incidence of civil wars (Cited in Do and Iyer, 2009).

Two sets of theories- polarization and horizontal inequality- are equally important in explaining armed conflict (Rustad et al., 2011). Both theories analytically focused on groups and provided similar explanations of how social, economic and political exclusion causally related to armed conflict. Polarization occurs when two or several groups exhibit significant inter-group heterogeneity in combination with intra-group homogeneity (Esteban and Ray, 1999 cited in Rustad et al. 2011). Similarly, horizontal inequality explains group identities and group differences. It is more important than inequalities between individuals and such inequality typically rooted in a long history of discrimination (Stewart, 2000 cited on Rustad et al. 2011). Murshed (2009 cited in Rustad et al. 2011) highlights four forms of discrimination that can lead to horizontal inequality: (1) Discrimination in public spending, taxation and public employment; (2) high asset inequality; (3) differential impact of public policies (especially economic mismanagement); and (4) access and allocation of resource.

Similarly, Collier et al. (2003) argue that the civil war impedes development, and equally development impedes war. Where development succeeds, countries become gradually safer from violent conflict that ensures subsequent development easier. On the other hand where development fails, countries are at high risk of falling into a conflict trap in which war destroys the economy and increase the risk of further war. They claim that some social, political, and economic characteristics systematically increase the incidence of civil war, and ethnicity and religion are much less important than commonly believed. By contrast, economic attributes matter more than has, usually, recognized. They conclude that the key cause of conflict is the failure of economic development. Once a country has tripped up into the conflict trap, which tend to lock it into a syndrome for further conflict (Collier et al. 2003).

2.4 Post-conflict Peace-building and Cost of Conflict

Peace-building refers to “attempt to overcome the structural, relational and cultural contradictions which lie at the root of the conflict” (Mial et al. 1999:36 cited in Ismail, 2008). Peace-building involves the creation of a set of realistic goals, policies and strategies. It aims to prevent the occurrence of armed conflicts; to avoid direct violence; to establish a legitimate framework for all the stakeholders in participating peacefully in economic, social, and political life of the country. It is not only peace-keeping by military operation and enforcing peace but also rebuilding society disrupted by conflict. It is about creating peaceful means to settle disputes and conflicts (Dahal, 2010). The concept “peace-building” invented by famous Norwegian peace researcher Johan Galtung and popularized by former UN Secretary- General Boutros Boutros-Ghali in 1992. The aim is to identify and support formations of peace in order to avoid a relapse into conflict and seek to stabilize the political situation (Dahal, 2010).

Peace-building often related to Galtung’s tripartite approaches to peace – peacekeeping, peacemaking and peace-building. Peacekeeping refers to the action seeking to stop and reduce violence of the conflict through the intervention of military power. Peacemaking aimed at reconciling political and strategic approaches through mediation, negotiation, arbitration and reconciliation. Peace-building addressed the practical implementation of peaceful social change through socio-economic reconstruction and development (Ismail, 2008:12). Other peace theorists reinforce this view by linking contemporary peace-building to the distinction between structural and direct violence, and between negative and positive peace. Lederach’s Conflict Transformation Approach to peace-building emphasized the transformative goal of peace-building. It focuses on opportunities for ‘creating constructive change processes that reduce violence, increase justice to direct communication and social structures, and response to real-life problems in social relationships’ (Ismail, 2008). Hence, the key tasks of peace-building could be the restoration of security, governance, development activities, humanitarian relief and reconciliation.

There are at least five, according to Ismail (2008), component of post-conflict peace-building: (1) disarmament, demobilization and reintegration (DDR) of insurgent to demilitarize society; (2) post-conflict reconstruction-rebuilding of physical infrastructure; (3) reconciliation (4)

humanitarian relief; and (5) social re-engineering (Ismail, 2008). Similarly, Dahal (2010) describes four main phases of peace-building as: (1) Immediate post-conflict intervention (ceasefire, the peace accord, election, human rights, humanitarian assistance); (2) Transactional peace-building (management of changed context, actors, issues and rules, security, life-supporting measures); (3) Reconstructive peace-building (disarming, demobilizing and reintegrating combatants, security sector reform, support to people, rehabilitation, reconstruction and reconciliation); and (4) Transformative peace-building (addressing the causes of the conflict and satisfying the basic needs of the community in post-conflict societies).

After the Comprehensive Peace Agreement between the major political parties and CPN (Maoist), in 2007, the UN Security Council has established United Nations Mission in Nepal (UNMIN) on the request of the CPN (Maoist) and the government. The aim is to support in monitoring of armed forces and arms, CA election and the peace process. Most of the donors in Nepal have now incorporated do no harm conflict sensitivity and peace-building components into their policy documents. So do the Ministry of Peace and Reconstruction, National Planning Commission of Nepal, line agencies, INGOs, NGOs and civic organizations. These efforts, however, lack coherence (Dahal, 2010).

Conflicts are costly. It has estimated that the cost of each conflict, in general, almost equals the value of annual development aid worldwide (House of Commons Report, 2005). It has economic, social, psychological, and the spillover effect. Numbers of studies have been conducted for analyzing cost of armed conflict all over the world. Skons (2005) reviewed the most comprehensive study of Brown and Rosecrance (1999), Stewart and FitzGerald (2001), Collier and others (2003), Nordhaus (2002), Bennis and the IPS Iraq task force (2002). He described the cost dimensions of armed conflict as; (1) cost to the parties of the conflict and (2) cost to the outside parties. Cost to the parties of the conflict consists of military expenditure and military casualties during the conflict, military expenditure after conflict. Similarly, it also includes economic and social impact and civilian casualties during the conflict and economic and social impact and post-conflict reconstruction after conflict. Cost to the outside parties includes military expenditure in neighboring countries, refugees, humanitarian aid and aid for reconstruction during conflict. Similarly, outside parties must also bear international and regional peace operation and humanitarian aid and aid for reconstruction after conflict (Skons, 2005).

During the civil war, According to Collier et al., (2003) incomes are around 15 percent lower than they would be otherwise implying that more than 30 percent of the people live in absolute poverty. However, the end of a civil war does not end the costs resulting from it. Conflict undermines the economy and leaves a legacy of violence. During the civil war, a society diverts some of its resources from productive activities to destructive activities. It makes a double loss: the loss from what the resources were previously contributing and the loss from the damage that they now apply. Military expenditure crowded out productive investment, therefore, decreases growth not only during conflict, but after conflict because military expenditure does not return its former level. Infrastructure destruction is the most obvious cost of war, and more substantial cost arises from the fear of violence (Collier et al., 2003).

Collier et al. (2003) investigate national, regional and global impact of civil war. Civil war increases the displacement, mortality, loss of social capital, capital flight and poverty within the country. Neighboring countries suffer civil war's economic and social spillover effects, drugs production and transport as well as spread of HIV/AIDS. Moreover, international terrorism grows as the global effects of civil war. Ninety-five percent of hard drugs production occurs in countries with civil wars and major supply routes run through conflict territories. A more speculative possible global price of civil war is the current AIDS pandemic (Collier et al., 2003).

According to Collier et al. (2003:17) that civilian casualty was about 10 percent at the beginning of the 20th century. By the 1990s, approximately 90 percent of the casualties resulting from armed conflict were civilian. During the civil war military expenditure, in an average, rises as a percentage of GDP from 2.8 to 5.0 percent and capital flight from such countries increase from 9 percent of private wealth to 20 percent. Civil wars undermine the efficient use of resources that could have allocated to other areas such as education, public health to improve the education system and the mortality rate. Military personnel tends to have high rates of sexually transmitted diseases (STDs), including HIV. Psychological damage in war survivors is one of the long-term impacts in society because war survivors have lost family members, friends, livelihoods, and identity. Similarly, landmines planted during the war affect both economic activity and public health even after conflict.

Economic theory suggests that an increment in government or military spending can crowd out private investment and may lead to lower rates of economic growth. However, some argue that military spending can also lead to some positive effects on economic growth by increasing aggregate demand which results in increased output and employment. Most research on the subject finds that defense spending tends to have an adverse impact on economic growth, either directly or indirectly (Pradhan, 2009). Staines (2004) explained three phases of the economic cycle related to conflict: phase of economic deterioration, the phase of contraction and phase of economic recovery. He explored the dynamics of pre-1990 and post-1990 conflicts and found significant differences in duration and costs of conflict in these two periods. Length of the overall conflict cycle, he observed, was 15 years in pre-1990 conflict and 11 years in post-1990 conflict. In pre-1990 conflicts, real GDP growth was 1.7% below average. For the conflict after 1990; real GDP growth was 12.3% below average considerably more than earlier conflicts due to deeper economic contraction and worse condition on initial recovery period (Staines, 2004).

Political tensions themselves could weaken various aspects of economic performance. Higher military spending may adversely affect economic growth in the long-run by two direct and interrelated ways. First, increases in military spending may diminish the total stock of resources that are available for alternative domestic uses such as investment in productive capital, education, and market-oriented technological innovation. Second, high spending on the military may aggravate distortions that decrease the efficiency of resource allocation, thereby lowering total factor productivity (Knight et al., 1996).

Landau (1993) studied the impact of military spending on economic growth with the sample of 71 countries. He found that the impact of military expenditure on growth is a combination of three effects as; (1) military expenditure increase security- positive impact on growth; (2) Military expenditure related to external threat develop pressure for efficient policies relating to security - positive result; and (3) diversion of resource from productive investment- negative result. These results will produce a non-linear relationship between military expenditure and growth. At low levels of military expenditure, there will be a positive impact on growth due to increased security and efficiency. While at higher levels it crowded out productive investment, therefore, create a negative impact on growth (Landau, 1993).

Chapter Three: Dynamic Problem and Hypothesis

3.1. Introduction

The previous chapter presents an overview of the literature relevant to the dynamics of insurgency development and associated cost of the insurgency. The chapter also analyzes causes and consequences of conflict in Nepal. This chapter continues the discussion on dynamics of insurgency, dynamic problem, the causal mechanism of insurgency, the actor, strategies and feedback mechanism of insurgency.

3.2. Dynamic Problem

There were a number of armed conflicts erupted in Nepal aiming to change the political regime. Nepali Congress raised arms against Rana Regime in 1951 and Panchayat Regime in 1962; the Communist Party of Nepal (Marxist-Leninist) involved in a guerrilla war aiming to abolish kingship from Nepal in 1972. However, insurgency during 1996-2006 created by the Communist Party of Nepal (Maoist) in the name of ‘people’s war’ has been able to create higher attention to the world community and its impact also much larger in term of social, economic, and political cost of conflict.

The popular movement in 1990 brought positive impact on economic activities in Nepal. Nepal was able to achieve above 5% growths due to policy reform by the elected government in 1990. However, due to insurgency started in 1996, growth began to decrease and reached negative in 2002 for the first time in 19 years (Pradhan, 2009). During the conflict, both the Maoist and the Security force have increased sharply. The Maoist fighting force that began with few insurgent and weapons expanded to around 31 thousand (Shakya, 2009). Similarly, security personnel grew to about 157000 from some 35000 (the World Bank, 2010). The government security expenditure in 1996 was about 0.9 percent of GDP while it reached 2.5% of GDP in 2006. Security expenditure between 2000 and 2006 grew by over 300 percent (Pradhan, 2009). More than 16000 lives have lost, and more than 400,000 families internally displaced while thousand other cross over India (Upreti, 2006). The estimated cost of conflict- direct and indirect-

according to Upreti (2006) was the amount of 119.07 billion Nepalese Rupees in year 2001/02, and 2002/03 including Maoist Army expenditure. That stands about 12% of nominal GDP. Similarly, Pradhan (2009) estimated that the opportunity cost of the conflict in terms of lost output has been about 3 percent of Nepal's current GDP. Besides, insurgency incidents made civil life difficult and forced donation and shelter to Maoist, especially in rural areas, further deteriorate their economic life. Insurgency also creates an adverse situation to the tourism sector one of an important source of foreign exchange and employment in Nepal. Economic growth during the conflict reached negative and still struggling to revive.

The problem of insurgency is very complex in term of actors' involvement; elements cause it and its impacts and cost. The impact of conflict cannot be limited to the parties involved in the conflict, but to those who do not have any direct relationship with the conflict. As discussed in Chapter two, armed conflict creates cost, not only for the country or countries in conflict but also for neighboring countries and international communities. Similarly, conflict creates costs not only during conflict, but also after conflict. Skons (2005) stated that the 'costs after the end of violence are often as high as the costs during conflict.' Insurgency has a feedback structure where elements within the system produce and receive feedback. It has dynamic properties i.e. the system changes and reacts to changes in its elements. Therefore, system dynamics modeling approach can better serve the objectives set forth in this research. Because system changes constantly, then the study of statistical correlation between variables as other studies applied. A model competent of capturing the dynamics involved in the conflict would be helpful in giving insight to decision makers about what policies should follow.

Besides, according to Gil et al. (2005), a dynamic modeling approach based on accepted theory about factors directly motivate its behavior and other exogenous (external) factors. The approach would result in a more appropriate vehicle for policy analysis than relying on statistical regression analysis of historical data or doubtful estimations. The overall goal of this thesis is to develop SD model to gain insight into the dynamic behavior of insurgency and its potential cost. It could be achieved by constructing a general model for simulating the initial establishment of security. Then by applying the general model to a notional scenario to determine which system parameters might have most affected the outcome of the insurgency in Nepal.

3.3. Conceptual Causal Mechanism of Insurgency in Nepal

As mentioned earlier, the fundamental proposition of this study is that the insurgency can be characterized as a system within which all behavior is generated related to the insurgency. Insurgency viewed as an armed contest between the state and counter-state for political control of the subject of population and its associated resources (Letch, 2005). Actors, their activities, resources, strategies and feedback structure need to conceptualize while modeling the insurgency dynamism. The development of this model based on the reading of literature and reviewing what the authors felt significant for analyzing the dynamic behavior of insurgency in Nepal. The model primarily based on Dr. Gordon McCormick's Counterinsurgency Model also known as diamond model and methods that have adopted by other researchers such as Dr. Edward G. Anderson, Dr. John A. Sokolowski, Damon B. Richardson, Nathan A. Minami, Nazli Choucri and other. McCormick's Counterinsurgency model provides a useful starting point to frame this conceptual mechanism.

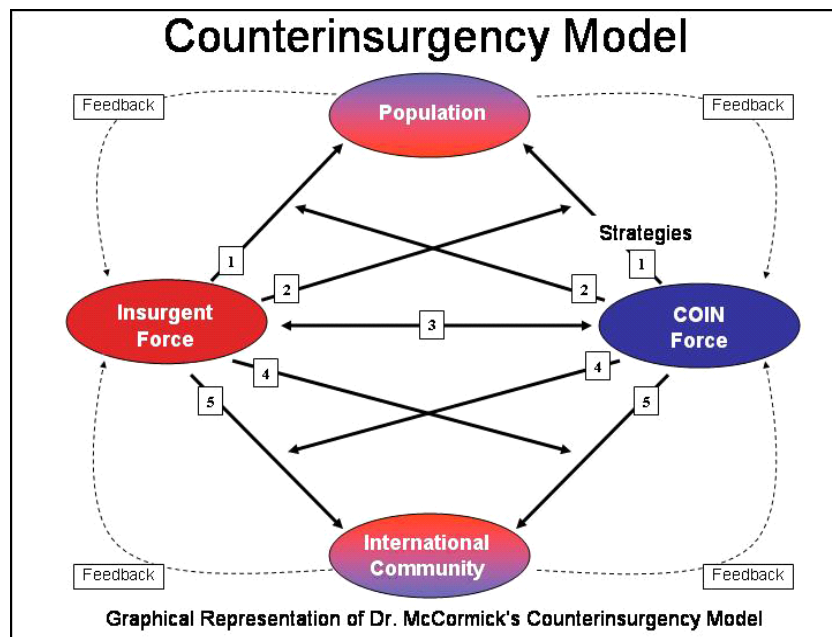


Figure 3.1: McCormick Counterinsurgency Model. Source: Canonico (2004)

The counterinsurgency model (see figure 3.1) demonstrates how both state and counter-state apply strategies, resources, and principles to achieve success. Letch, (2005) explains both insurgent and counterinsurgent as a part of the system set a target against the backdrop of

geopolitical, social, economic and cultural conditions that describe resources, constraints and opportunities for political control of the target group. He argues that Insurgents and counterinsurgents represent system convert inputs (e.g. people, money, material, and information) into outputs (i.e. government programs, military operations, rewards) using their available infrastructure (e.g. government-rebel administration, training, logistics). Input may come from national or international community. Therefore, both insurgent and counterinsurgent rely on people for information and affects people with its output.

The model depicts actors (section 3.3.1), strategies (section 3.3.2) and feedback mechanism (section 3.3.3) for those forces. The upper half of the model explains internal environment of the host nation and lower half explain external environment. The overall strategy (internal to the state) identifies the populace as the center of gravity. The state and counter state agent pursue the strategy of gaining support from the international community (Canonico, 2004; Letch, 2005).

3.3.1 The Actors

Counterinsurgency model in figure 3.1 shows four types of actors have played direct or indirect role in insurgency dynamics: the Security Force, the Insurgent Force, the Population and the International Community.

The security force is the state forces include police, military, intelligence infrastructure and trainer. In Nepal, during insurgency Nepal Army, Armed Police Force, Nepal Police and Intelligence department mobilized in the name of joint security operation. According to Canonico (2004), the security force must integrate all element of national power such as civil, military, diplomatic, informational, economic and financial. They must clearly identify the legitimate target among insurgent that can often hide in the local populace while conventional security force can easily identify by their standard uniforms, base and vehicles. Similarly, distinguishing voluntary insurgent and coercive support of insurgent is the most difficult obstacle to the SF.

The insurgents are those either actively or passively supporting insurgent movement including active fighters, supporters, infrastructure. Maoist insurgent in Nepal grouped into hardcore Maoist fighter, militia members, active political cadres, and active supporters (Letch, 2005). Sometimes many organizations may involve in an insurgency. For example during Cuban

Revolution there were multiple organizations working to remove Batista from the power (Canonico, 2004).

The population is in the center of gravity in the model; both state and counter state pursue their activity for gaining popular support. Population should be considered neutral to insurgency consists of non-combatants in the country. Coercive supporter may not consider insurgent until they give clear support to the insurgent. Both state and counter state rely on people for their strength. Population support or oppose state or counter agent by providing information. However, people may not be considered pro-insurgent or pro-government until they provide information above or below the base level (Canonico, 2004).

International community consists of external states, international organizations and other groups working in direct or indirect support role. They remain neutral until they provide support to one or another side; once they provide support becomes part of insurgent force or security force. The aim of this study is not to analyze international influence on the Maoist insurgency, so external factors excluded from the model.

3.3.2 The Strategies

McCormick's counterinsurgency model explains both insurgent and counterinsurgent apply five basic strategies during insurgency: three relating to the internal environment and two related to the external environment. These strategies are: (1) gain control and support of people; (2) identify and dismantle the infrastructure of the enemy; (3) defeat the opponent through direct actions; (4) disrupt opponent relations with the international community; and (5) establish a relationship with the international community (Canonico, 2004; Letch, 2005). His model is simple and powerful, but certain aspects must be examined in more detail if the model is to be applied to the situation in Nepal.

The population neutralizes the strength and weakness between security force and insurgent force (Canonico, 2004). They heavily rely on popular support during insurgency. Loudly voiced slogans and strategies during the insurgency in Nepal such as 'by, with, and through the people' or 'hearts and minds,' refer to the importance of winning popular support in an insurgency or counterinsurgency. However, these mantras sound logical but offer little practical advice to

address the issue (Letch, 2005). It is hard to measure why and when it matter, what people think and who must care more about people than enemy. During the insurgency many innocent person killed/tortured in the name of the spy by both forces do not support their popular slogan. These issues are critical to understanding insurgent and counterinsurgent systems in active conflict. Moreover, help to explain why McCormick argues that the logical sequence of the strategies begins with gaining widespread public support and ends with attacks on the enemy (Letch, 2005).

Both insurgent and counterinsurgent fulfill various needs through popular support. Although security force is strong in resources, personnel and training, they usually lack intelligence on insurgent. Therefore, security force needs intelligence to identify legitimate target, calibrate and control insurgent without innocent casualties because innocent casualties will degrade the public support. Similarly, Insurgents need public support to increase resources, employees and place for hiding. Insurgents are attempting to diminish the government's legitimacy through attacks, propaganda, demonstrating inability to provide security to the people and the other way of control (Canonico, 2004).

Population during insurgency is under extreme pressure from both sides because each side wants the people to act in a manner favorable to them. Contrary to their expectation they might exact brutal revenge to village informants and their family if discovered. Hence, such support is the primary input to the growth and operational capacity of each side. Next they pursue the strategy of identifying and destroying opponent's infrastructure. If they succeed in this strategy, in addition to material effect, they might be able to limit the production of output hope to further impact on populace preferences. Finally, each party targeted the output of other in order to score direct physical or psychological damage to the opponent (Letch, 2005).

Most of the insurgency/counterinsurgency becomes battles for legitimacy and strong international support. During the insurgency, both sides pursue their strategy of disrupting opponent's international relation and establish their strong relationship so as to enhance their legitimacy. They also seek material, financial, weapons, training and other logistic supports from the international community along with verbal support (Canonico, 2004). The more they rely on internal resources, the more burden of proof rest on the population that converts their dissatisfaction toward them.

3.3.3 The Feedbacks

Feedback is critical for understanding the effects of insurgent and counterinsurgent's action on people and international perceptions (Canonico, 2004). These perceptions are the basic information to the conflicting parties for their further actions. The feedback connections allow forces to assess both the success and failure of their operations. Feedback mechanism allows the researcher to understand the dynamism of insurgency/counterinsurgency, how input converts into outputs and back again inputs.

3.4. Causal Loop Diagram

As discussed earlier, the insurgency depends on the population dynamics including loops about state capacity, public opinion, violent acts by insurgent and counter-actions by security forces. The characteristics of insurgency in Nepal bear similar issues. The model by Anderson (2006), Sokolowski and Banks (2007), William (2009) and Minami and Kucik (2009) have provided the closest proximity to what is occurring in Nepal. This section will briefly present the causal mechanisms behind the various dynamic factors active in the insurgency in Nepal as well as describing some possible behaviors. The causal loop diagram is a method of explaining the relationship between variables. Arrows connect all variables with the polarity. The plus (+) sign indicates the changes (increase or decrease) in one variable leads to changes in another variable in the same direction. The minus (-) sign indicates the opposite change between the variables. The time delay in the system is denoted by (\neq) sign.

3.4.1. Incident Suppression and Insurgent Creation

The Maoist has expressed strong disagreement with the Constitution of Kingdom of Nepal 1990. However, the Maoist participated in the first parliamentary election after 1990 using its open forum 'Joint Peoples Front' and won nine seats in the parliament. Later the strong fraction of the Maoist party boycotted the second election and declared war against the regime. In 1996, the Maoist formally declared war with the regime by attacking police post in rural districts (Rolpa and Rukum). In response, the government launched Operation Romeo and Kilo Sera II to suppress the insurgency. These counterinsurgency operations interrupt civil life. As a result,

people dissatisfied with the government and turned into support to the insurgent. A small movement swept across the country like wildfire. The point of departure of the model is about insurgent incident and insurgent creation mechanism in the system shown in figure 3.2.

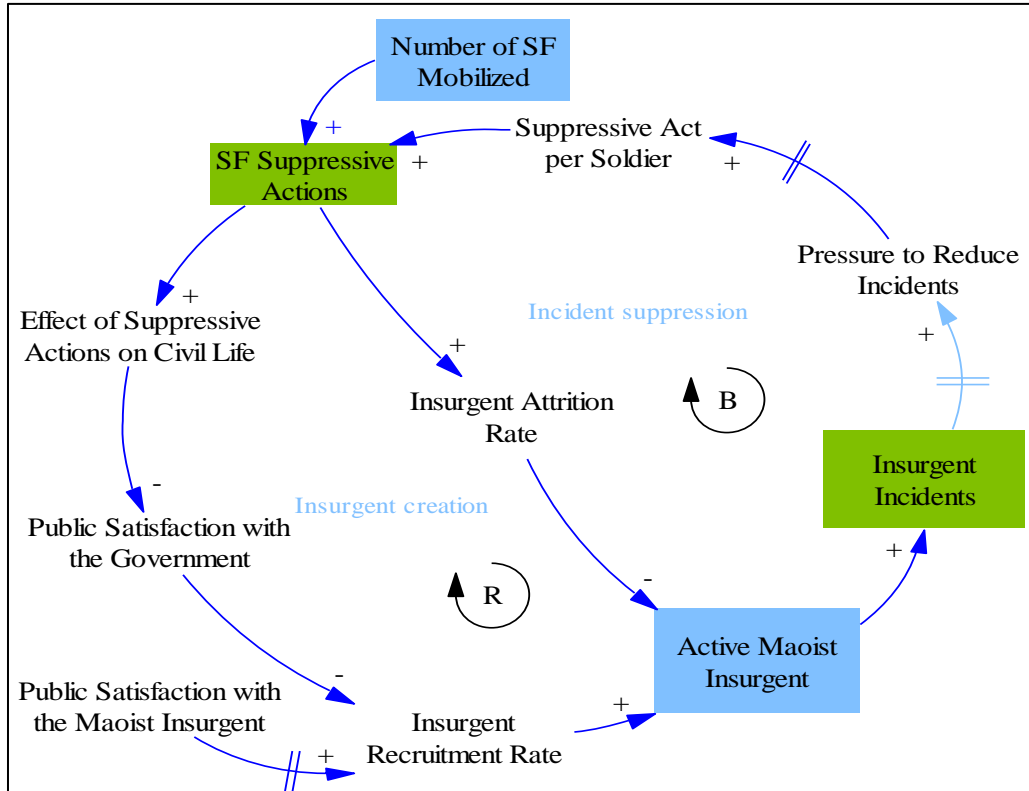


Figure 3.2: Incident suppression and insurgent creation loops

Incident suppression loop shows that an increase in the number of Maoist insurgent will result in an increase the number of incidents. With increased incidents, the populace becomes upset and shouts for the government to do something to stop the incidents. As a result, the government will use force to suppress the insurgency. The more suppressive action by security forces will capture or kill the insurgents, therefore, reduce the number of insurgent and incident. This loop tends to balance the number of insurgents. SF suppressive actions have determined by the number of security force mobilized (denoted as security force mobilized) and suppressive actions per soldier. It is a balancing loop (marked by 'B' in the diagram) because higher insurgent at a point of time will finally reduce their number at another point of time. Short delay exists between pressure to reduce incidents and actions by security forces, because of time needed to implement suppressive policies.

However, the security force suppressive actions are not free of cost. The constant interference of security forces in the daily lives of the people leading to dissatisfaction toward the government that turned into support to the insurgent. It may stimulate more people to join the insurgency; therefore, increase in a number of insurgents leads more violent incident and more pressure to reduce incidents. This pressure will cause higher suppressive action and further interference in civil life and completed the loop by the increasing number of insurgent still more. The behavior of insurgent development described in the figure 3.2 shows when recruitment is greater than attrition the stock of insurgent increases and vice versa. The dynamism of this loop can best explain why initial small Maoist movement started in small rural areas, spread all over the country in a short time and able to control two third of the area. It is reinforcing marked by 'R' in the diagram. Reinforcing loops, according to Anderson (2006), typically are the engine of growth in system dynamics. Reinforcing loops work on both directions, also create a vicious cycle.

3.4.2. War Weariness and Growth of Security Force

Incident suppression and insurgent creation loop in Figure 3.2 cannot perfectly describe how insurgency uprising ultimately ends. Figure 3.3 adds a security force growth loop and a war-weariness loop to the model.

The conflict in Nepal has been on-going for a number of years. As discussed before, even before Maoist insurgency there were a number of political changes experienced (see also Annex II). The popular movement in 1990 reestablished multi-party democracy in the country supposed to establish long-term peace and stability in the country. However, due to failure of delivering the promise by the political parties create space for further conflict in the name of Maoist insurgency. Long political instability in the country resulted in a loss of populace confidence in the government's ability to provide basic services and security to them. As violent incidents increases, civil society, human right activists criticize the government and create pressure on the government for a peaceful solution of the conflict. It creates pressure on the government to pull security forces back from the operation so as to create an environment for dialogue. The war weariness loop is balancing because populace continues to be tired of the insurgent activity, therefore, create pressure to increase the dialogue rather than use of more force. According to

Anderson (2006) this loop seems to come into effect only once the insurgent creation loop has begun to dominate the model.

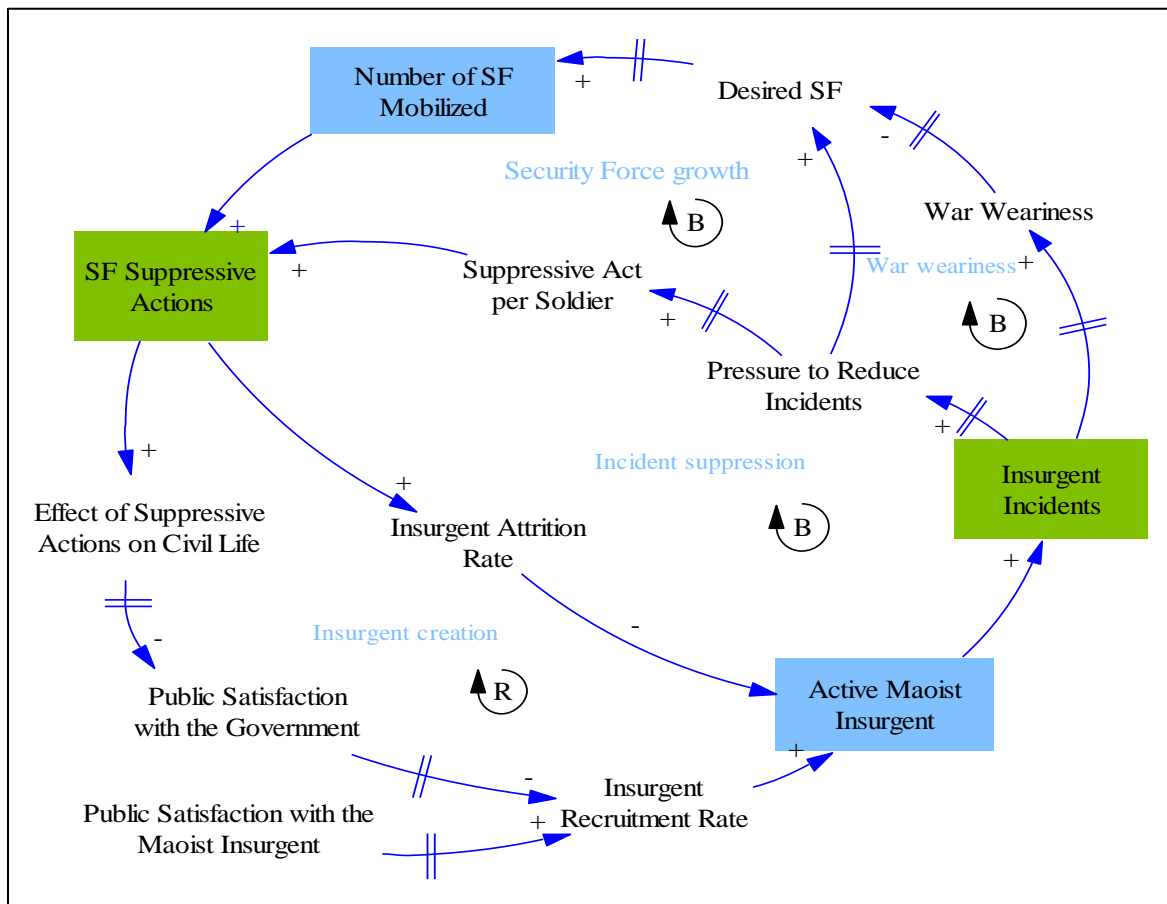


Figure 3.3: War weariness and security force growth loops

Further, adding Armed Forced Growth loop in the structure, is also balancing loop, could determine how much security forces required for suppressive actions. Both pressure and war weariness messages come from the populace influence the policy of usage and growth of security forces. With increased pressure, the government needs to deploy more security forces for effective security actions to reduce violent incidents. This loop tends to create pressure on the government to recruit more security forces so as to deploy them into counterinsurgency activity. This loop, of course, helps to reduce the number of insurgents either through arrest or killing but also increases misuse of power and disturb civil lives that feed into the insurgent creation loop. Additionally, insurgent propaganda message will also increase dissatisfaction with the government because people can see how government soldiers entertain them.

3.4.3. Fundraising Effect, Resource Replacement, and Insurgent Depletion

Four loops-fundraising, weapon and resource replacement and fundraising effect and insurgent depletion- further added in the structure shown in figure 3.4. Fundraising loop describes weapon stockpiles and source of finance of the insurgent. Fundraising effect and Insurgent depletion loops describe how people's satisfaction changes with fundraising activities and insurgent incidents. The more the insurgents rely on the internal source for their required resources, the more its effect on populace satisfaction that influences insurgent recruitment.

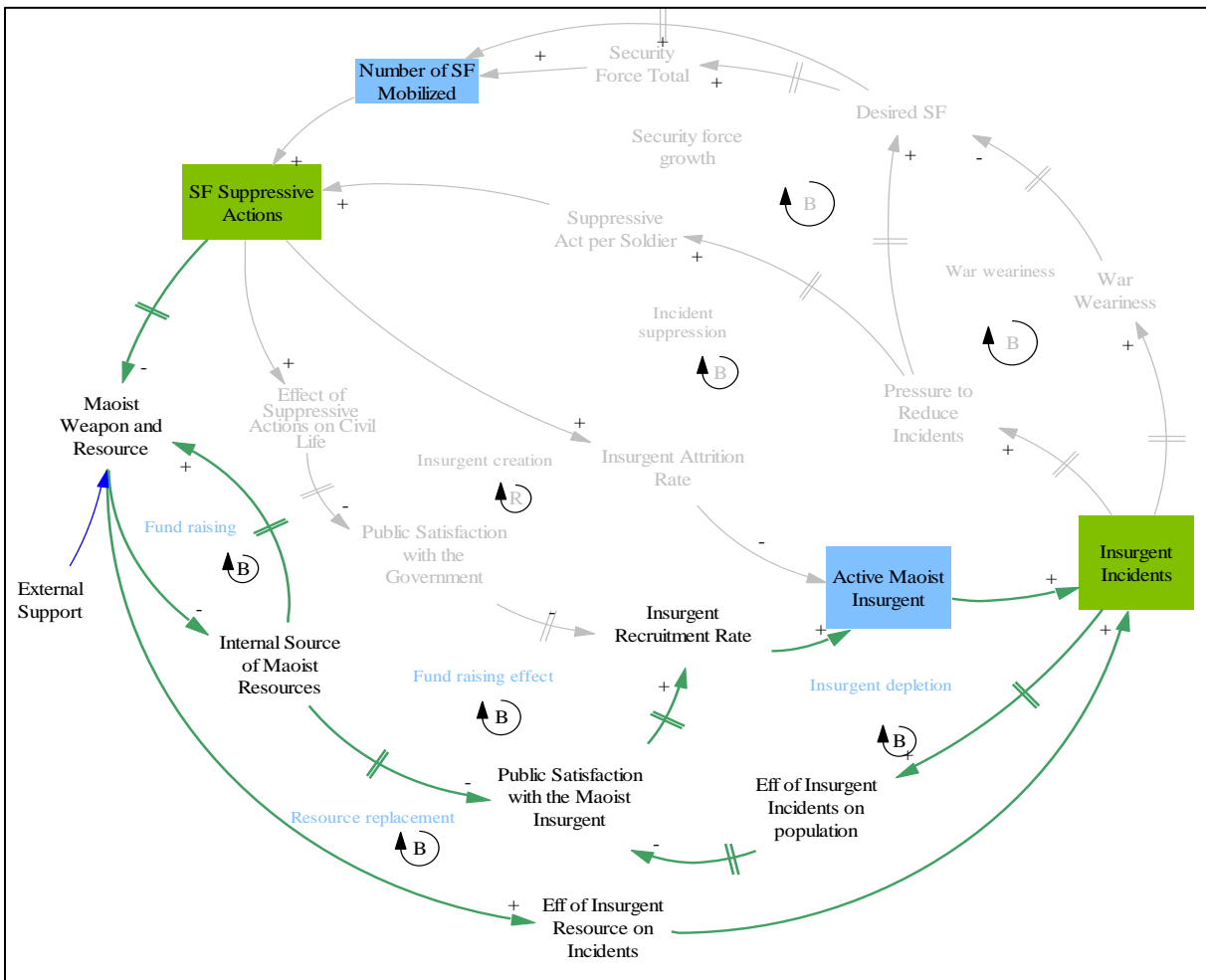


Figure 3.4: Fundraising Effect, Resource replacement and Insurgent Depletion loops

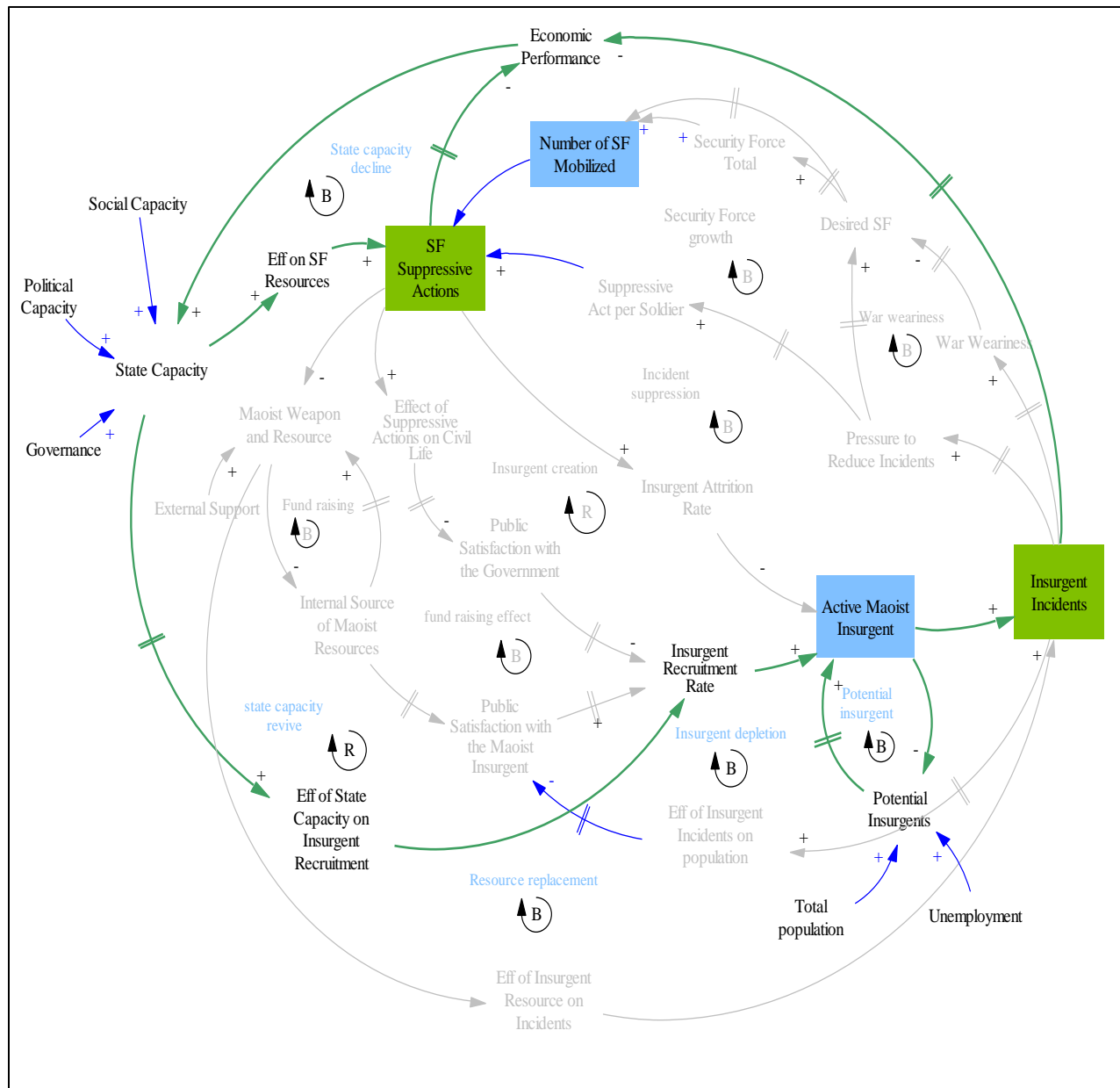
Weapon and resource replacement loops explain security force suppressive actions decrease the resource availability to the insurgent as well as insurgent incidents. Ultimately, if there are no funds to replace weapons, the number of incidents reduced to zero and the insurgency will

become dormant. To avoid this, the insurgent will ideally acquire either fund from external or internal sources. This fundraising activity refills the stock of resources and, therefore, reestablishes the insurgent capacity to create insurgent incidents (Anderson, 2006). Internal sources include donation, levy from member and supporter, looting government bank, charges to business in the territory under their control. External sources include donations from supporters living outside country, support from political allies from abroad especially communist organizations. Internal fundraising activities mainly include extortion and other unpopular means of coercion. It may erode them popular support, therefore, moderate recruitment and hamper the ability of active insurgents to evade capture by hiding among sympathetic populaces.

In the Fund Raising Loop shown in figure 3.4, insurgents use both external and internal resource to support their material needs and funding. This loop is balancing because higher internal support increases their stock of the weapon and other resources that result in less internal fund needed in the future. However, as discussed earlier, internal fundraising involve coercive activities by the Maoist insurgent, which affects popular support to insurgent and their recruitments represented in fundraising effect loop. In the weapon replacement loop, government forces' suppressive activities reduce the number of weapons available to the insurgents and their ability to conduct incidents. The ability of committing incidents depends on insurgent number and which largely depends on the peoples' support.

3.4.4. Potential Insurgent and Economic Impact

The final three loops added in the structure are potential insurgent, state capacity decline and state capacity revive loops. Figure 3.5 shows the result of population dynamics and unemployment upon the model. Population age 15-49 is a major source of insurgent. Perhaps, if the population growth rate declines or unemployment drops, the number of young persons who are physically capable of participating in an insurgency will decrease and vice versa. In Nepal, according to the National Survey 2001, 23 million people live in the country; of which 53 percent are between age 15 and 59. Regarding unemployment, the World Bank data shows employment to population ratio during the insurgency time varies 81 to 85 percent. Therefore, 15 to 19 percentage of the population are unemployed. Similarly, according to Nepal Labor Force Survey, 30 percent of economically active population is underutilized (unemployed or underemployed).



Both insurgent and security force activity obviously have an adverse effect on the economy. The Maoist mainly involves strikes, blockades, direct attacks, and destroy infrastructure. Similarly, security force committed in search of public and private transportation, house searching, limiting the movement of people, and counterattacks. During the insurgency in Nepal, these actions and counteractions are common and have an adverse effect on the economy. The economic performance contributes in strengthening or weakening the capacity of state along with other variables. According to Choucri et al. (2006) that the regime resilience (capability) can militate

against insurgent recruitment, therefore, reduce insurgent incidents as well as the adverse effect on the economy. If the economy is doing well or if the regime perceived as having increased legitimacy, there is less likelihood of individual become an insurgent shown in state capacity revive loop. The key determinants of state capacity as indicated in the social science literature are economic performance, legitimacy, political capacity and social capacity (Choucri et al. 2006). The equation below represents the aggregate state capacity as;

$$\begin{aligned} \text{State Capacity} &= \alpha_t * \beta_t * \gamma_t * \delta_t * \varepsilon_t * \omega_t \\ \text{Polity index: } \alpha_t &= \text{Polity}_t / \text{Polity}_{1996} \\ \text{Civil liberties index: } \beta_t &= \text{Civil liberties}_t / \text{Civil liberties}_{1996} \\ \text{GDP Index: } \gamma_t &= (\text{GDP}_t / \text{Population}_t) / (\text{GDP}_{1996} / \text{Population}_{1996}) \\ \text{Employment Index: } \delta_t &= \text{Employment per Capita}_t / \text{Employment per Capita}_{1996} \\ \text{Literacy Index: } \varepsilon_t &= \text{Literacy}_t / \text{Literacy}_{1996} \\ \text{Governance Index: } \omega_t &= \text{Governance}_t / \text{governance}_{1996} \end{aligned}$$

State capacity related with the economic performance of the county. Sound economic activity improve state capacity and will initiate to reduce potential stock of insurgent and actual insurgent. Consequently, violent incident and their intensity drop which create less pressure on the government to reduce incidents. The state can able to invest resources into productive investment that lead further economic growth. This loop is reinforcing and creates long-term impact on the insurgency management. If this loop generates the vicious cycle, the country may fall into conflict trap i.e. conflict undermine growth by different way and lower growth increases risk of further conflict. Polity index, civil liberties index, employment index, literacy index and the governance index are used as exogenous variable and GDP index as endogenous variable in the model. The time series data derived from different sources used to calculate the indices in this study.

Chapter Four: Methodology

4.1. Introduction

This chapter will describe the system dynamics modeling approach, model boundary, selection of variables, rate of change and flows, stock and flow diagram and data used for this research.

4.2. System Dynamics Modeling Approach

‘System dynamics is a methodology for studying and managing complex system that change over time’ (Ford, 2010:7 cited on Winz et al., 2008). ‘It is an approach for modeling and simulating complex physical and social systems and experimenting with the models to design policies for management and change’ (Choucri et al. 2006). Especially, computer modeling used to focus on information feedback loops that give rise to the dynamic behavior and to understand the impact of time delays and non-linearity in the system. System dynamics allows the researcher to analyze complex system from a cause-and-effect perspective, rather than from a statistical standpoint. It provides flexibility to the researcher to utilize both conceptual understand as well as empirical data collection (Gil et al. 2005; Choucri et al. 2006). System dynamics model offers unique abilities to contribute to social science, economics, or political science modes of study (Choucri et al. 2006).

Dynamic simulation enables to observe the behavior of the system and its response over time. It consists of equations describing dynamic change. Behavior of the state at one point of time, if known, the behavior of the state at another period can be computed (Winz et al., 2008). Unlike statistical modeling in which equations developed following observation and compared the output with historical data; system dynamics models are causal mathematical model comprised of the structure of the system that gives rise to its observable and predictable behavior (Forrester, 1961, Sterman 2000 and Barlas 1996 cited on Winz et al. 2008). In system dynamics modeling, researcher needs to determine system structure consisting relationships between variables, feedback, system archetypes and delays. The understanding system structure requires a focus on

the system as a whole rather than a part of it. It is necessary to understand the system as a whole to manage complex system in real life situation (Sterman, 2000).

System Dynamics Modeling consists of qualitative and quantitative modeling methods (Dolado 1992 cited in Winz et al. 2008). Causal loop diagrams improve one's conceptual or qualitative inquiry and stock and flow diagram explain the structure and behavior of the system applying mathematical equations. Quantitative modeling using stock and flow diagram allows investigating and examining the effect of various interventions through simulation. It also requires conceptual understanding and assumptions be underlying the model (Winz et al. 2008). The system dynamics comprised of problem definition, system conceptualization/hypothesis, model formulation, model evaluation/testing, policy analysis and implementation (Sterman 2000). The purpose of this study as mentioned earlier is to understand and analyze dynamism of Maoist insurgency in Nepal and estimate underlying cost to the country. System Dynamics Modeling Approach could be useful methodological choice to understand the nature and behavior of insurgency and its overall cost to the society and country as a whole.

4.3. The Model Boundary

Structure and environment of insurgency is very complex because there are a number of actors involved, a number of elements cause it, and multi-dimensional result it produces. There may be a huge number of variables in the system. It is hard to incorporate all such variable in the model due to time and resource constraints; therefore, it is imperative to describe the consideration about model structure and environment. The primary concern of this research is to describe insurgency dynamism and its cost to the society and nation as a whole. However, number of possible elements could not be analyzed and left for further study. The model boundary designed in this study will help to explain model structure and its environment. It also ensures modeling process is in the right track. It also helps people to understand the scope of the model. Table below shows model boundary in this model. Variables used in the model classified as Endogenous, Exogenous and Excluded. Endogenous column explains dynamic variables involved in the feedback loop. Exogenous explains for components whose values are not directly affected by the system, and excluded column shows the relation that this model does not consider due to some reason.

Table 4.1: Variables Used in the Model

Endogenous	Exogenous	Excluded
Increasing rate of insurgent	Security Force normal growth rate	Annual cost of insurgency
Additional SF increasing rate	SF expenditure	Total cost of insurgency
Insurgent incidents	Base population	
SF actions	SF parameter, suppressive parameter, satisfaction parameter and other parameter	Cost of insurgency % of GDP
Indicated insurgents	Time delay of various element in the system	
Change in Satisfaction	GDP normal growth fraction	
Potential economic effect	Social capacity, political capacity and governance	
State capacity		
Insurgent weapons and resources		

4.4. Selection of Variable

In system dynamics modeling, it is necessary to determine model structure, which is critical. It needed to generate a model that creates the problem, and it must contain “all the interacting relationships needed to lead the system into trouble” (Forrester, 1969:113 cited in Richardson, 2004). If modular fail to build a model with all interacting relationships, internal process of the system lead in a different direction (Forrester, 1969 cited in Richardson, 2004). So the selection of variables is an important aspect of system dynamics modeling that can represent different aspects of the state of the system.

This study selected 11 level variables with the purpose they describe the insurgency dynamism and the cost of insurgency collectively. These variables classified in four basic categories: (1) insurgent and security force activity, (2) public satisfaction, (3) effect of insurgency on the economy, and (4) cost of the insurgency.

4.4.1 Insurgent and Security Force Activity

Insurgent and security force activity sector describe their activities, strategies, support and growth over time. In the insurgency situation, both security forces and insurgents involve different activities so as to gain superiority over other. State activities during insurgency include patrolling, house searching, intelligence, civil affair, capturing and elimination, neutralization, creating a favorable environment for development and population resettlement. According to Letch (2005), the elements of counterinsurgency system in Nepal are security forces including village self-defense force, intelligence resources, and national and village level officials. Three distinct state security forces-the Royal Nepal Army (now renamed Nepal Army), the Armed Police Force and the Nepal Police- deployed in the counterinsurgency operation during the insurgency from 1996 to 2006. In the beginning, the government deployed Nepal Police to combat insurgency. Later in 2001, the government declared a state of emergency and authorized the RNA to enter the conflict and engage offensively to combat insurgency (Letch, 2005).

Exogenous support received mainly from China, India, UK, and USA. It includes mainly capital investment and development, medicine and physical infrastructure, military equipment, weapons, night vision helicopters, secure communications spare parts and training to RNA. However, when the King takes over all political rights in 2005; the international communities reacts the step and virtually all military and development aid suspended or placed under review since February 2005 (Letch, 2005). Letch (2005) argued that Nepal's fundamental limitations are political unity, security, intelligence and resources during insurgency.

The Maoist activities mainly include building strength, harassment, intimidation, strikes, and collection of resources; evacuate police station and government offices from the rural area. They also involved in attacking security force base camp, collection of money by using coercive means, looting bank and other government agencies, terrorizing people and forced to join and support Maoist. They use three instruments to achieve their goals: the party, the People's Army, and the United Front. The uniformed People's army and the non-uniformed village militias are a major strength of Maoist during insurgency (Letch, 2005; Upreti, 2010; Marks, 2003). It is hard to determine the exact number of Maoist insurgent due to the poor state intelligence. There is lacking unanimously saying about their number. However, some tentative guesses are available.

For example, Letch (2005) argues that there were 5000 to 10,000 hardcore Maoist fighter; 10,000 to 15,000 militia members; 15,000 to 25,000 active political cadres; and 100,000 to 150,000 active supporters. However, After the CPA between the major political parties and CPN (Maoist), the UN Security Council has established United Nations Mission in Nepal (UNMIN) registered 32500 Maoist combatants. Later after verification the number reduced to 19602 (Himalayan times daily).

The Maoist foresees three strategic phases: strategic defensive, strategic stalemate and strategic offensive. Strategic defensive is the period of growth used to build forces, political control in a remote village. It aimed at target attack against unarmed civilians, robberies and extortion of food and money. Activities during this phase designed to strengthen forces and resources. In strategic stalemate phase, the Maoist concentrates on direct attack against weak elements of the security forces and creates psychological pressure on the public. They concentrate on to secure their hold on the area of their influence; impose their education text, courts and security. The Maoist on one hand, enter cease-fire agreements and on the other use the time to re-arm of forces and gain public support. In the strategic offensive phase, they focused to take control of remaining countryside and increase pressure on the economy and people of the urban area (Letch, 2005). According to Letch (2005) that the Maoist insurgents enjoy intelligence advantages at the operational and strategic level.

Although there are three types of security forces: the RNA, the Armed Police Force and the Civil Police engaged to combat insurgency. However, for simplicity of the model no separate level variable designed for all security forces. Two level variables designed to represent all three security forces: (1) the number of SF at normal, taking constant growth fraction based on historical data before insurgency start, and (2) the number of additional security force required. Insurgents mapped with one level variable: (1) the number of active Maoist Insurgent.

4.4.2 Public Satisfaction

The Maoist insurgency did not happen and bloomed suddenly in 1996. It was the product of continuous ignorance of necessity of the lower segments of Nepali society, weak governance, and the state failure in addressing issues of caste, ethnicity, and language. Democratic

government's inability to resolve the political dispute within the jurisdiction of directive principles of the constitution also create nurturing environment for insurgency in the country (Marks, 2003; Letch, 2005).

Public satisfaction is an important level variable in this model that explains how insurgency blows up. The government chose very coercive approach to combat the insurgency at the initial stage instead of dialogue and negotiation. Romeo, Kilo Shera-2 and Jungle Search are major military operation launched in 1998-1999. In addition, the government launched Silent Kilo Shera-3, Delta and Chakrabyuha Operation in 2001 to combat insurgency (Upreti, 2010). These coercive operations become counterproductive to the government because of higher casualty of innocent people. Principally, insurgent incident activate pressure to reduce incident and war weariness with shorter and longer delay respectively over the time. It is the reason government chooses coercive actions against Maoist initially, but later the government realizes that popular support matter during counterinsurgency operation and launched Internal Security and Development Programme (Upreti, 2010). Therefore, there was no conflict between Maoist and security force at that time. Insurgent incidents also have influences on the level of satisfaction with the Maoist over time.

This variable measures support or oppose to insurgent and security force. Dissatisfaction with the government favors insurgent and dissatisfaction with insurgent favors security force. Public satisfaction represents two level variables: public satisfaction with the government and public satisfaction with the insurgent. These variables varied with the activities of both the security force and insurgents. These variables assume to act as a proxy for the perceived legitimacy of the government because the development of legitimate government is essential to the creation of sustainable security (Richardson, 2004).

4.4.3 Impact of Insurgency on Economy

Insurgency has economic, social, psychological, and spillover effect. Effect of insurgency may not come immediately but is unavoidable if insurgency starts. Insurgency adversely affects economic activities and reduces income and leaves a legacy of violence. Increased military expenditure crowded out productive investment and reduced the growth that may not return its

original level even after conflict. Displacement, mortality, loss of social capital, capital flight, and poverty are common effects of civil war. Psychological damage in war survivors is one of the long-term impacts in society because war survivors have lost family members, friends, livelihoods, and identity (Collier et al., 2003).

However, the purpose of this study is to examine the impact of insurgency on the economy, so the effort paid to estimate loss of economic performance due to insurgency. Gross Domestic Product at insurgency compared with the GDP at hypothetical normal situation. Three level variables designed to measure economic result of the insurgency: (1) level of economic effect of insurgency, (2) the amount of GDP at normal, and (3) the amount of GDP at insurgency. The amount of military and insurgent activity is the measure of potential economic effect. Normal GDP growth fraction estimated based on the historical data and GDP at insurgency was the function of economic effect of insurgency and normal growth fraction. The effect of the economy to insurgency dynamics was also assumed. A strong economy enhances government role along with political, social, military, governance capacity which favor SF operation and vice versa.

4.4.4 Cost of Insurgency

The Maoist insurgency, as discussed earlier, has been able to achieve significant changes positive or negative in the country. It has established federalism by abolishing 240 year old institution- the monarchy and remarkable awareness in the populace, but is not free of cost. More than 16000 lives lost thousands of the government building and infrastructure destroyed billions of rupees spent on insurgency and counterinsurgency operations, and billions of rupees spent on managing insurgent after conflict. Cost of armed conflict to the internal parties can be, according to Skons (2005) personal, security, economic, social, human rights and sovereignty. Similarly cost of the insurgency can also be grouped into direct cost, indirect cost and hidden cost (Supinajaroen, 2011). Direct cost is the cost that directly used during and after insurgency measured in four categories: (1) the amount of additional security force expenditure, (2) the amount of Maoist insurgent expenditure, (3) the amount of Maoist voluntary retirement cost, (4) the amount of Maoist cantonment cost, and (5) the amount of after war cost.

Indirect cost is the cost related to insurgency and counterinsurgency operation also known as the opportunity cost. It is the effect of insurgency on the economy. The amount of loss of GDP represents indirect cost of the insurgency comes from the effect of insurgency on economy sector. Hidden cost used in insurgency and counterinsurgency operation but is needed after insurgency has finished. In reality, this cost relates veteran Medicare or social welfare (Supinajaroen, 2011). The level value after the insurgency cost represents this cost. Inflow to this value comes from additional security force expenditure and integration cost of insurgent. The lifetime of this cost assumed as 30 years based on age of soldier and life expectancy. Three level variables designed to determine the cost of the insurgency as after war cost, cantonment cost and total cost of the insurgency.

4.5. Rates of Change or Flows

The level variables described in the previous section capture the state of insurgency dynamism and its environment, but by themselves do not develop over time. The rates of change or flows describe how those level values evolve over time. The model developed in this research is a network of interconnected level variable and rate of change or flow. Each level variable has one or more rate of change associated it. These flows determine how level value changes over time and together they determine how the entire system evolves over time. Table 4.2 lists each of level value and associated flows in the model and the Figure 4.1 presents stock and flow structure of general insurgency dynamics and cost of insurgency model. The direction of changes indicated by the sign + or – indicating an increase or decreasing in the level value over time.

Table 4.2 and figure 4.1 present level variable and associated rate of change of insurgent and security force activity, public satisfaction, impact of insurgency on the economy and cost of the insurgency. Insurgents classified into active insurgent. **Active insurgents** are the person actively involved in insurgency activity. This stock increases with ‘insurgent recruitment rate’ and reduce with ‘insurgent attrition rate’ and ‘insurgent retirement rate’ over time. The unemployed people are the main source of insurgent recruitment and affect the level of public satisfaction with the state and Insurgents. Population assumed as exogenous variable increasing at the constant rate of growth over time.

Table 4.2: Level Values and Associated flows

Level value	Direction of change	Flows
Active Maoist Insurgent	+	Insurgent recruitment rate
	-	Insurgent attrition rate
	-	Insurgent retirement rate
Security Force normal	+	SF normal growth rate
Additional Security Force	+	Additional SF increasing rate
Public Satisfaction with the Government	+	Chg in satisfaction with the government
Public Satisfaction with the Maoist	+	Chg in satisfaction with the Maoist
Normal GDP	+	Normal GDP growth rate
GDP at Insurgency	+	GDP at insurgency growth rate
Economic Effect of Insurgency	+	Insurgency effect increase rate
Cantonment Cost	+	Cantonment cost growth rate
After Insurgency Cost	+	After Insurgency cost growth rate
	-	After Insurgency cost decrease rate
Total Cost of Insurgency	+	Total cost growth rate

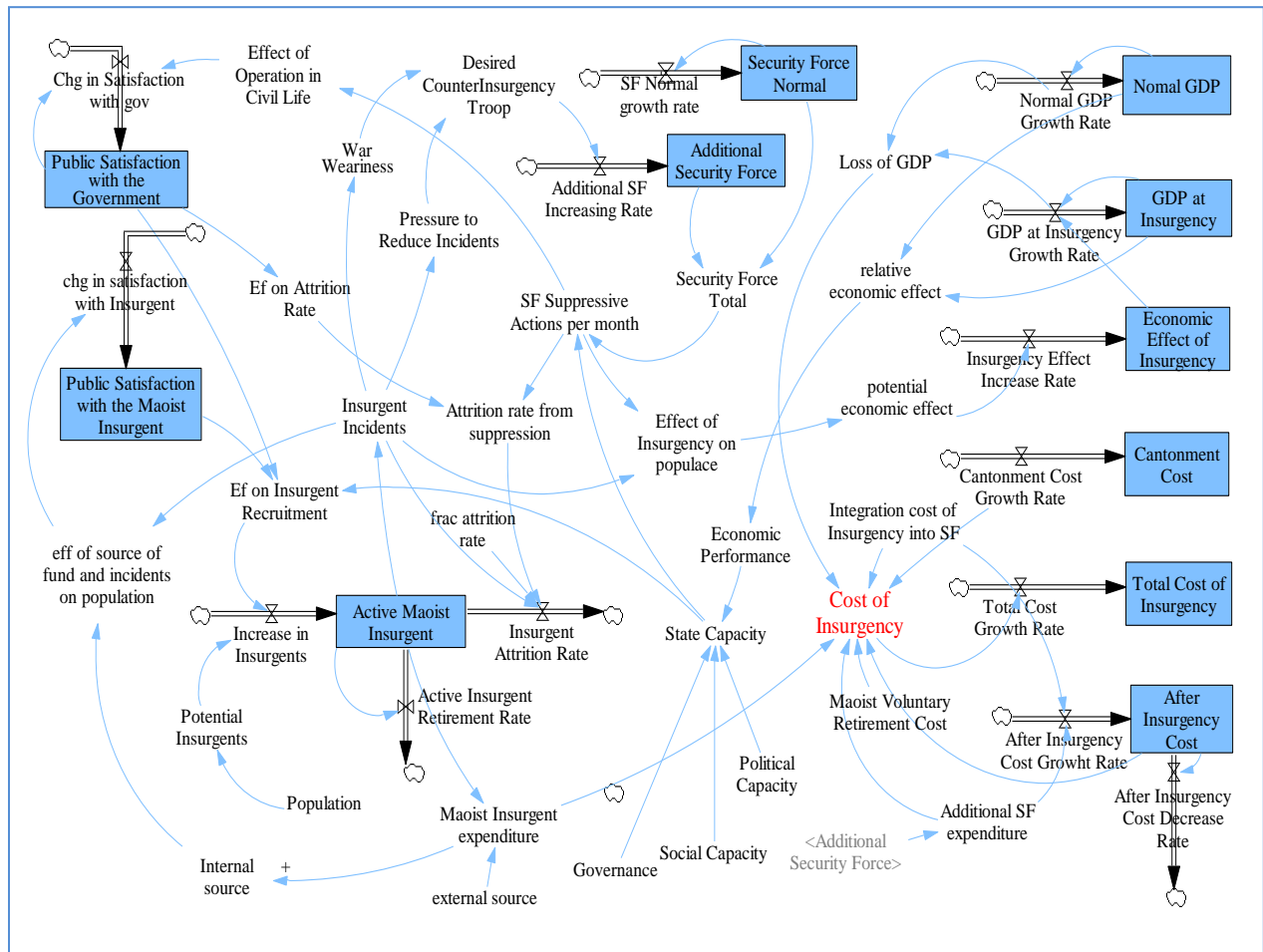


Figure 4.1: General Overview of Insurgency Dynamics and Cost of Insurgency Model

Nepal Army, Armed Police Force and Nepal Police were engaged in a counterinsurgency operation. For the simplicity of the model, all elements of security forces combined into one named Security Force. It is assumed that recruitment in security force is not constraint because the government can easily recruit as much as required from about 30% un/underemployed people (National Labor Force Survey, 2001). It was found that a large number of the applicant applied for a job in security force when vacancy announced. Security force increases by a constant growth rate based on historical data and additional force required with demand generated by the intensity of the insurgency.

The level value ‘Public Satisfaction with the Government’ measures the level of satisfaction with the state. The level of satisfaction varies from '0' to '1', one being satisfaction and zero being the dissatisfaction. The level of satisfaction varies with change in satisfaction determined by the effect of security force suppressive action on populace.

The level value ‘Public Satisfaction with the Maoist Insurgent’ measures the level of satisfaction with the Maoist. The level varies from '0' to '1'. The level of satisfaction varies by the change in satisfaction that is the function of insurgent resources and their activities. The more they collected required resources from the internal sources; the lower will be the level of public satisfaction toward them. Similarly, insurgent activities interrupt civil life that turned into dissatisfaction with the Maoist. This level has influences on their recruitment capability.

The level value ‘Normal GDP’ and ‘GDP at insurgency’ is the measure of economic performance. The difference will be the loss/benefit of GDP due to insurgency. The flow to the normal GDP assumed as a constant growth rate based on historical data. The rate of change in GDP at insurgency varies over time with the effect of intensity of the insurgency. GDP index is the proxy measure of economic performance which share state capacity along with the other external variable as governance, social capacity and political capacity.

The level value ‘Economic Effect of Insurgency’ is the measure of to what extent insurgent incidents and suppressive actions by the security force affect the economic activity in the country. This effect determines effective GDP fraction during insurgency and compared with the

normal GDP fraction. As discussed earlier, Collier et al. (2003) observed that while the civil war incomes are around 15 percent lower than otherwise would have been in normal condition.

The level value ‘Cantonment Cost’ measures the management cost of insurgent including monthly allowances of insurgent in cantonment or camps under the Comprehensive Peace Agreement (CPA) signed in November, 2006. The integration process of People’s Liberation Army into Nepal Army started thereafter. There were 32500 combatants in cantonment at the beginning. After the verification, UNMIN, qualified 19602 combatants and kept in cantonment. They were paid 3000 rupees monthly allowance in the beginning, and later the amount increased to 6000 Nepalese rupees. A total of 1460 ex-combatants formally join Nepal Army and those uninterested in joining Army get voluntary retirement with a lump sum amount of 500,000 to 800,000 depending on the rank. The integration chapter finally concluded in Dec. 2012. Altogether in management of combatant and cantonment, the government spent 20 billion rupees from Nov, 2006 to July, 2012 (Himalayan Times Daily and Karobar daily, 11 Aug. 2013).

The level value ‘After Insurgency Cost’ measures the social welfare of insurgency victims and ex-soldiers. Inflow to this value is after insurgency cost growth rate and is a function of additional security force expenditure and insurgent integration cost. The lifetime of this cost is set around 30 years.

The level value ‘Total Cost of Insurgency’ shows overall cost of the insurgency that the country suffers. The rate of change 'total cost growth rate' is the function of all direct, indirect and hidden cost variables.

4.6. Stock and Flow Diagram

Figure 4.1 describes the overall structure and environment of the Maoist insurgency and cost of conflict in Nepal. To make the model simple and understandable, it has divided into four sub-models. These sub-models are (1) insurgent and SF activity sub-model, (2) public satisfaction sub-model, (3) economic effect of insurgency sub-model, and (4) cost of insurgency sub-model. In the following four sections, the flows associated with each of the level values or stocks explained. The level values shaded by blue color; the variables that affect another sector marked by green color and the shadow variables represent the variable coming from other sectors.

4.6.1 Insurgent and Security Force Activity Sub-model

This sub-model is developed so as to capture the interaction among the insurgent, the security forces and the population. Figure 4.2 presents the structure of the insurgent and security force activity and insurgent resources, its development over time showing associated rates of changes.

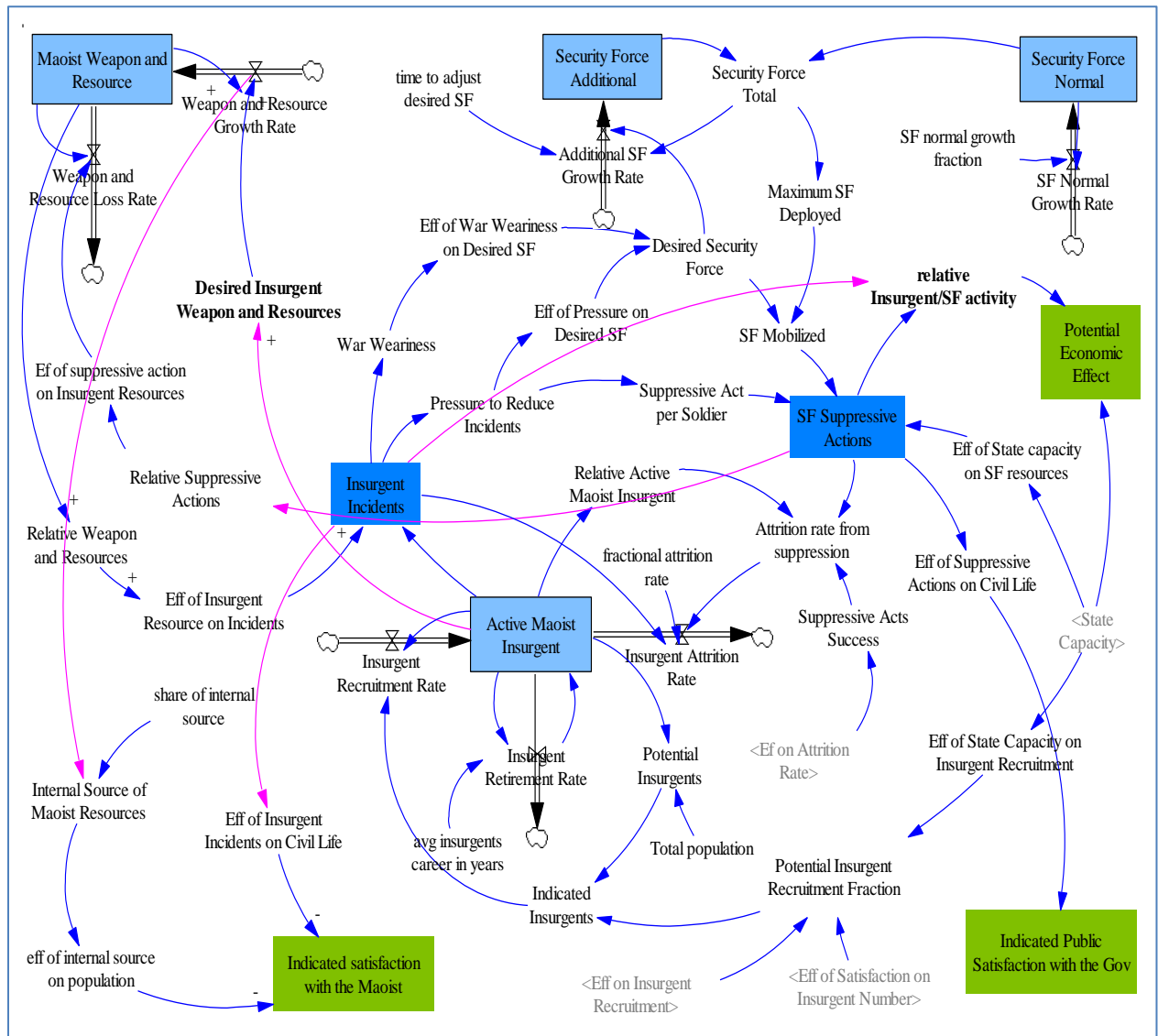


Figure 4.2: Insurgent and Security Force Activity Sub-model

One level variable identified to represent the number of insurgents; two level variables designed to represent the number of security forces, and one level variable designed to represent the amount of insurgent resources. All of the level variables have a different influence on other rate and variables in the model. There are three types of security institutions in Nepal as Nepal Army,

Armed Police Force and Nepal Police. All these forces jointly mobilized in the operation during insurgency. So none of separate level variable searched for representing them separately; rather attempt has made to differentiate security force growth at hypothetical normal period and additional security force growth due to additional demand for combating insurgency. The reason behind this formulation is to estimate the additional cost incurred due to insurgency.

Level values have been changed by the corresponding rate of change, other level values and other variable in the system. Rectangular boxes represent level values; solid arrows represent flows and arrows represent link between level values, flows and variables (parametric inputs). Value of the stock determined by the equation as $Stock_t = Stock_{t-dt} + Inflow_{dt} - Outflow_{dt}$

Active Maoist Insurgent represents the institution of insurgent. The size of insurgent institution depends on insurgent recruitment rate, insurgent attrition rate (killed or captured) and insurgent retirement rate. Recruitment of insurgent materialized from the population stock dissatisfied with the regime. Attrition of insurgent rate depends on the intensity of insurgent incidents and suppressive actions by security force. The rate of change of Active Maoist insurgent defined by the following equations;

$$Insurgent Recruitment Rate = IF THEN ELSE (Time < end of insurgency time, MAX ((Indicated Insurgents - Active Maoist Insurgent) / time to join insurgency, 0) * insurgent creation loop switch, 0)$$

This equation drives the annual number of active insurgents to what their indicated level should be based on public satisfaction with both the state and the Maoist.

$$Insurgent Attrition Rate = Insurgent Incidents * fractional attrition rate per incident + Attrition rate from suppression.$$

This equation measures annual number of insurgent attrition. Insurgent Attrition Rate is the sum total of attrition from suppression and fractional attrition rate * insurgent incidents. Suppressive acts by SF represent their effort to capture, demobilize, neutralized or killed the insurgent through suppressive actions. These actions depend on the number of security force deployed in the operation, resource available and maximum use (capacity of SF). Insurgent incidents represent the insurgency activities by the Maoist insurgent. Number of active Maoist, weapon

and resource availability and capability of individual insurgents are the variables that determine the number of insurgent incidents.

$$\text{Active Insurgent Retirement Rate} = \text{Active Maoist Insurgent} / \text{Avg Insurgents Career in Years}$$

This equation measures the regular retirement of insurgent. Average insurgent career in years is estimated 12 years.

Security Force Normal and Additional Security Force represent two level values; Security Force Normal and Additional Security Force and its growth over time determined by two rate of change. Although there are three institutions of SF in Nepal, but for the purpose of this study, only two stocks designed to represent all security forces. The inflow assumed at normal situation, and necessity arises to recruit additional security personnel due to insurgency. SF also recruited from the stock of the eligible population. The corresponding inflows of the level values defined by the equations as;

$$\text{SF Normal Growth Rate} = \text{Security Force Normal} * \text{SF normal growth fraction}$$

SF Normal Growth Rate initiated by exogenous growth fraction estimated based on the historical data. As discussed earlier, political changes in 1990 established multi-party democracy in the country brought various internal security challenges due to increased mass mobilization by the political parties. A small number with less equipped security forces could not able to manage frequent strikes, political mobilization and criminal activities efficiently. Not only Maoist insurgency, but also other factors influence in increasing the number of security force. Fixed growth fraction is taken based on the historical data that initiate SF growth rate at normal.

$$\text{Additional SF Increasing Rate} = \frac{(\text{Desired Security Force} - \text{Security Force Total})}{\text{adjustment time for desired security force.}}$$

Additional SF Increasing Rate represents growth of the number of security force due to insurgency and depends on the development of desired security force. Desired security force represents the expected security force necessary for effective suppressive actions and influenced by pressure to reduce incident and war weariness. Both war weariness and pressure to reduce

violent incident are due to insurgent incidents. Short time delay activates pressure to reduce incidents and longtime delay needs to be wearied about insurgency.

Insurgent Incident and SF Suppressive Actions measure the activity of both insurgents and security force in the model. Insurgent incidents are mainly insurgent's activities including building strength, harassment, intimidation, strikes, collection of resources, evacuate police station and government offices from the rural area. These incidents pressurize the government to take actions against them because civil society, business sector, and general public demand more security. However with the long delay, war weariness will also emerge due to negative effects of war. These two influences generated by the insurgent incidents determine how much SF needs to be deployed in suppressive actions. Security force suppressive actions include patrolling, house searching, intelligence, civil affair, capturing and elimination, neutralization, creating an environment for development and population resettlement. Both insurgents and security force activities are determined by their strength in number, soldier capacity, and resource availability. These activities have an effect on public satisfaction, which is the important source of information to both of them, and also influences on economy and cost of the insurgency.

Maoist Weapons and Resources measure fundraising activities and its impact on public satisfaction with the Maoist. The corresponding inflow and outflow of the level values expressed as the following equations as;

$$\text{Weapon and Resource Growth Rate} = \text{IF THEN ELSE} (\text{Desired Insurgent Weapon and Resources} > \text{Maoist Weapon and Resource}, (\text{Desired Insurgent Weapon and Resources} - \text{Maoist Weapon and Resource}) / \text{time to fulfill desired resource}, 0)$$

This equation measures the insurgent's weapons and resource acquisition activities. Maoist uses both internal and external source for their necessary financial and material resources. It is hard to estimate their fund requirement and collection from internal and external sources. However, some predictions are available. According to Letch (2005) Maoist funding comes mainly through a mix of coercive and criminal activities such as 40% extortion from individuals and businesses; 20% looting and bank robbery; 25% illegal trade in narcotics; and 15% external sources (primarily Nepali Diasporas in India and the U.S.). The number of insurgent strength and minimum substantial amount per person could be the proxy of their requirement of fund denoted

by the variable **desired insurgent weapons and resources**. Insurgent weapon and resource per person including insurgent army accessories, food, clothing, shelter and weapons were estimated by taking consideration of Nepal's per capita income, availability of low wages laborer, and their voluntariness against the state.

$$\text{Weapon and Resource Loss Rate} = \text{IF THEN ELSE} (\text{Time} \leq \text{end of insurgency time}, (\text{Maoist Weapon and Resource} / \text{weapon and resource depletion time}) + (\text{Maoist Weapon and Resource} * \text{Eff of suppressive action on Insurgent Resources}), 0)$$

This equation measures the loss rate of weapon and resources. The stock of resources depletes at a normal rate plus loss from suppressive actions by the security force during insurgency. Corresponding influences of Insurgent weapons and resources assumed in this study as the impact on Maoist ability to create incidents and effect on the public support to them.

4.6.2 Public Satisfaction Sub-model

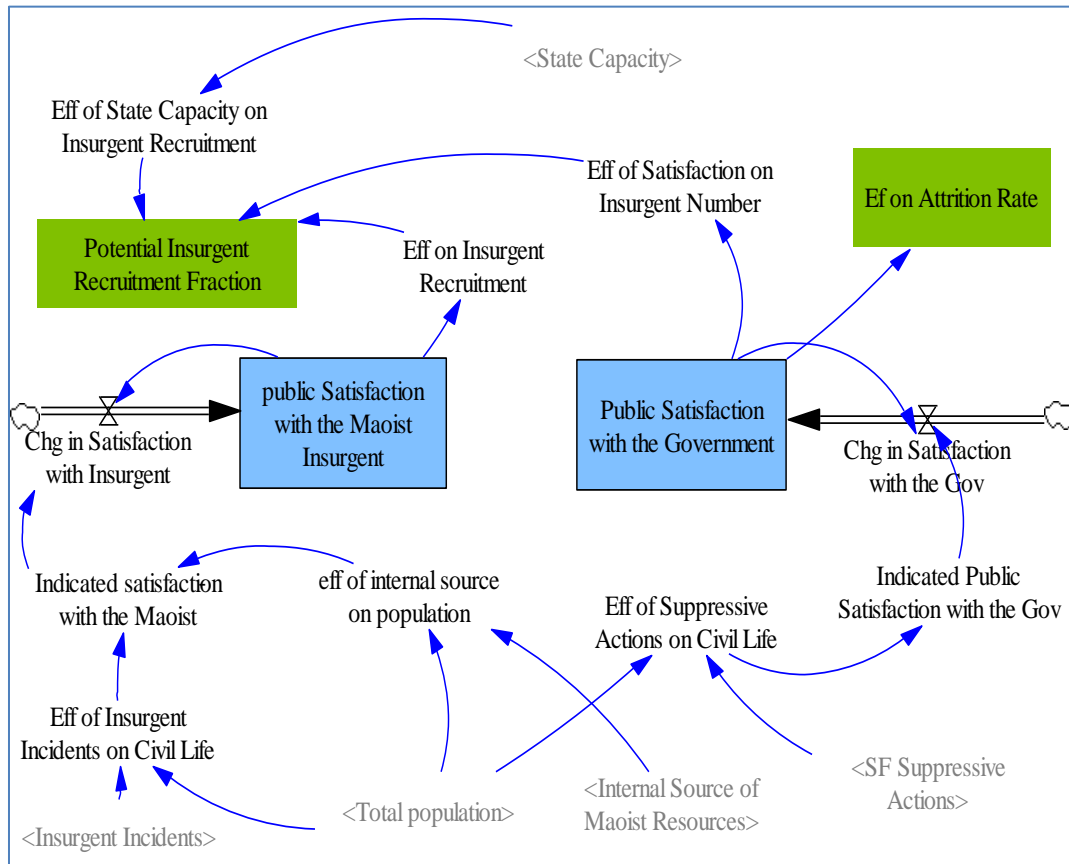


Figure 4.3: Public Satisfaction Sub-model

Public Satisfaction with the Government is an important level value in this model. This level influences the rest of the model in two ways. Satisfied people with the state provide information to the security force that supports the effectiveness of suppressive actions while dissatisfied people facilitates insurgent recruitment. The public satisfaction rate of change denoted by the equation as;

$$\text{Chg in Satisfaction with the Government} = (\text{Indicated Public Satisfaction with the Gov} - \text{Public Satisfaction with the Government}) / \text{IF THEN ELSE} (\text{Indicated Public Satisfaction with the Gov} > \text{Public Satisfaction with the Government}, \text{time to satisfy}, \text{time to dissatisfy})$$

This measures how quickly public satisfaction with government changes. Note that the time for satisfaction and dissatisfaction is different.

Public Satisfaction with the Maoist Insurgent measures how insurgent incidents and their resource collection efforts affect public satisfaction with them. Insurgent activities and means of fund collection determine the level of public satisfaction toward them. The Maoist, as discussed earlier, heavily relies on the internal source of funding. The more they rely on internal sources especially from donation from the general public, the higher the people dissatisfied with them. This level variable affects insurgent recruitment rate. The public satisfaction rate of change with the Maoist expressed by the equations as;

$$\text{Chg in Satisfaction with Insurgent} = (\text{Indicated satisfaction with the Maoist-public Satisfaction with the Maoist Insurgent}) / \text{IF THEN ELSE} (\text{Indicated satisfaction with the Maoist} > \text{public Satisfaction with the Maoist Insurgent}, \text{time to satisfy}, \text{time to dissatisfy})$$

$$\text{Indicated satisfaction with the Maoist} = \text{MIN} (XIDZ (1, (\text{Effect of Insurgent Incidents on population} + \text{effect of internal source on population}), 1) ^{\text{satisfaction parameter}}, 1)$$

4.6.3 Impact of Insurgency on Economy Sub-model

This sector shows the result of the insurgency that is unavoidable if insurgency happens. Three level values have taken to measure the impact of insurgency on the economy such as Economic Effect of insurgency, GDP at Normal Situation and GDP at Insurgency shown in figure 4.4.

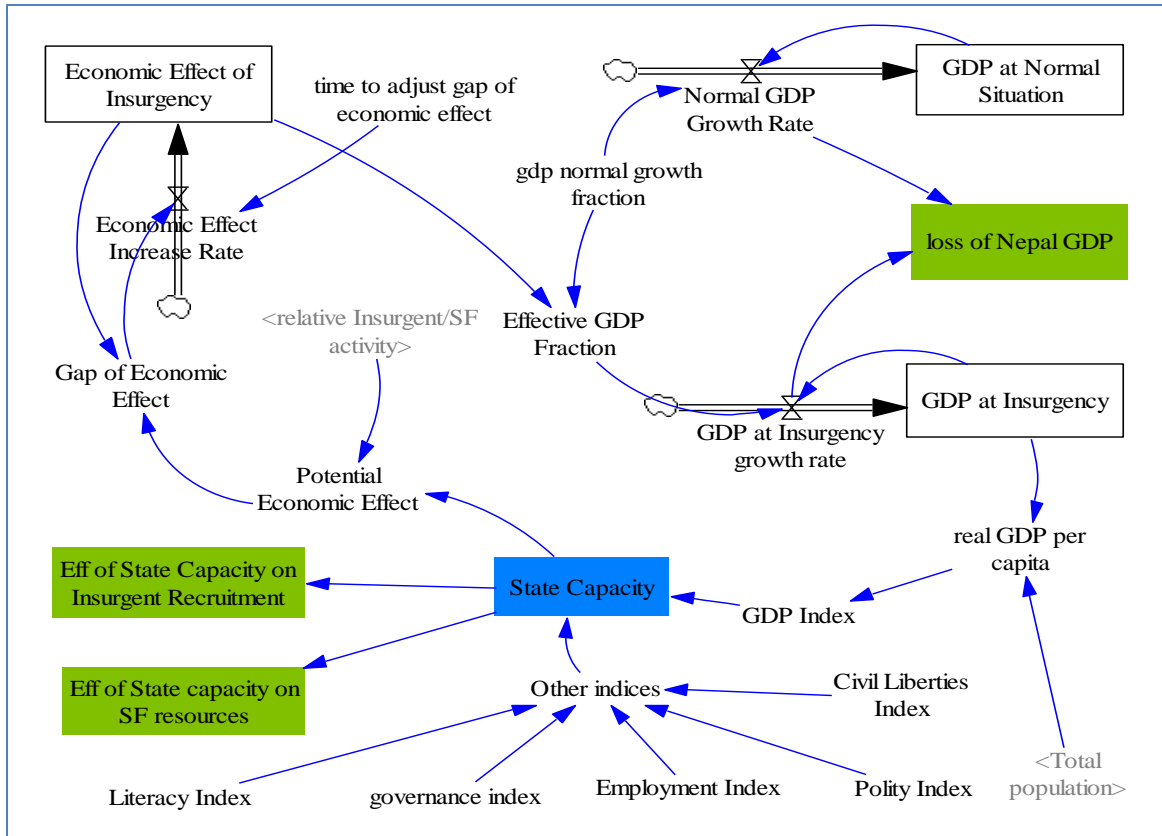


Figure 4.4: Impact of Insurgency on Economy Sub-model

Economic Effect of Insurgency is a key indicator represents the sensitivity of economy to the insurgency. The potential economic effect compared with this level value in order to determine the rate of change of this value with the adjustment time of three years.

Economic Effect Increase Rate = Gap of Economic Effect / time to adjust gap of economic effect

*Potential economic effect = (1 - XIDZ (1, "relative Insurgent/SF activity" * (1 / State Capacity), 1) ^ economic effect parameter) * economic effect switch*

Potential economic effect depends on relative insurgent/SF activity, and it is a function of insurgent incident and security force suppressive actions. Both insurgent incidents and security force suppressive action have taken to determine the relative value of such actions.

Normal GDP and GDP at Insurgency show the development of economic indicator in two dimensions. The stock Normal GDP grows in a constant growth rate based on the historical data whereas GDP at insurgency rely on the intensity of the insurgency hence slower than a normal

operation but is necessary after insurgency has finished. In reality, this cost relates veteran Medicare or social welfare (Supinajaroen, 2011). The level value after the insurgency cost represents this cost. Inflow to this value comes from additional SF expenditure and integration cost of insurgent. The lifetime of this cost assumed as 30 years based on age of soldier and life expectancy. Three level variables designed to determine the cost of the insurgency as after war cost, cantonment cost and total cost of the insurgency.

4.7. Data Used

Historical data are an important element of system dynamics modeling. Historical data support the model to be justified and reasonable. Information used in this model comes from many sources of references. For example, the initial number of insurgent was estimated on the basis of previous research and the UNMIN report used to estimate the total number of insurgent. Historical information of Military expenditure and number of armed force personnel was taken from the database of SIPRI. Similarly, nominal and real GDP and other economic data were taken as a reference from World Bank data and statistics and Economic Survey of Nepal. Website of Nepal Army, Armed Police Force, Nepal Police and other government websites and online newspapers are other important sources of information. All the data collected as primary information process and interpreted into required monetary and other terms. Various model validation processes have been conducted to make sure that the model is not much sensitive on the unsure variables.

Chapter Five: Dynamic Behavior and Sensitivity Analysis

5.1 Introduction

The fundamental premise of this study, as discussed earlier, is that the insurgency characterized as a system within which all behavior related to an insurgency generated. Structure of the system developed in the previous section describes level variables, rate of change, other variables and parameter built in the system. The efforts have made to discuss how these variables behave and how they interact to other variable. Similarly, model validation and sensitivity analysis will also be conducted so as to establish confidence about the usefulness of the model.

5.2 Dynamic Behavior

Structure of insurgency dynamic discussed in the previous chapter composed of the number of stocks or level variables, flows or rate of change, variables and parameter. Each variable generates behavior affect other variables, and other variables affect it, as well. Insurgency as a system has feedback structure where elements in the system produce and receive feedback and the system responds to changes in its elements. Development in the level values over time shows the system elements influenced by other elements in the system. The dynamic behavior of the system compared with the reference mode taken from the available historical data and assumptions. The parameters have adjusted accordingly that the simulated behavior could best fit with the reference mode.

5.3 Validation of the Model

According to Sterman (2000) ‘valid implies being supported by objective truth’ and by this definition ‘no model can be verified or validated’. Theories or models are falsifiable and had to be possible to falsify it by experiment (Sterman, 2000:847). However, the reliability of any model can be enhanced by the process of validation that is the primary consideration of people to justify each design. “Validation is the process of establishing confidence in the soundness and

usefulness of a model”(Forrester and Senge 1980 cited on Supinajaroen, 2011). It is crucial to verify and validate the model before simulating different scenarios and making decisions about it (Campuzano and Mula, 2011). The main purpose of validation is to increase justifiable confidence in the model. Justifiable confidence based on the evidence that the model performance replicates the reference mode; structure causes its performance, and equations are internally consistent. Similarly, decision rules represent the real-world situation; parameters estimation is sufficient for the intended purpose; and documentation is sufficient for third party replication.

Sterman (2000) described the most significant test to verify the model such as boundary adequacy, structural assessment test, dimensional consistency test, parameter assessment test, extreme condition test, error integration test. Similarly, he also described behavior reproduction test, sensitivity analysis test, behavior anomaly test, family member test, surprise behavior test, sensitivity analysis and system improvement test. However, it is hard for this research due to time and resource constraint that the model would pass through all these tests. In this study behavior reproduction test, boundary adequacy test, dimension consistency test, direct extreme condition test, structure-behavior test, the integration error, and sensitivity analysis were applied. The test of model structure will test the whole model together. However, the test of the model starts with each sector separately, emphasis given to test Insurgent and Security Force Activity sector. It is the main sector of this system. Meanwhile, the other three sectors; Public Satisfaction, Effect of Insurgency on Economy and Cost of Insurgency tested, as well.

5.3.1. Behavior Reproduction Test

Behavior reproduction is the effort to see how fit the model to simulate with the historical data or reference behavior shown in figure 5.1, 5.2, 5.3 and 5.4. The figures compare the simulated behavior and historical data. The blue line represents a dynamic behavior of historical data, and red line represents simulated behavior.

The historical data relating to the number of security force, gross domestic product, and military expenditure were taken from World Bank statistics, SIPRI and economic survey of the ministry of finance and other related government websites. Nevertheless, it is difficult to identify the

exact number of Maoist Insurgent. For the purpose of this study, the number of Maoist insurgents is based on other scholar's estimation and verification by UNMIN after end of the insurgency. The expected result of the model simulation is to replicate the reference mode in term of quality and quantity. The purpose of this study is to develop a generic model which can describe the behavior of insurgency. So the behavior fitting in term of quality is acceptable.

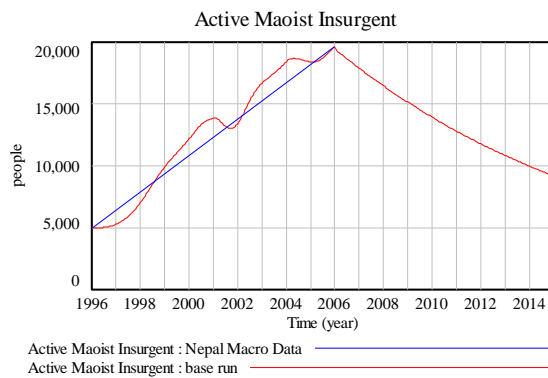


Figure 5.1: Base Run-Active Moist

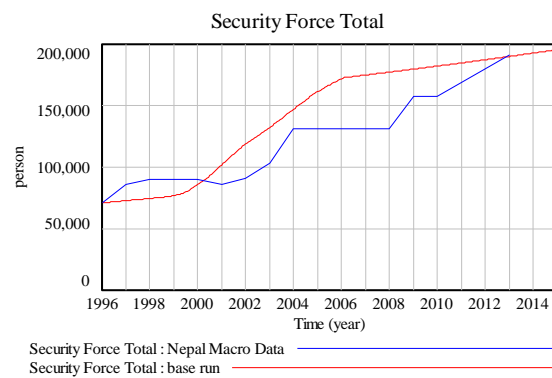


Figure 5.2: Base Run-Security Force Total

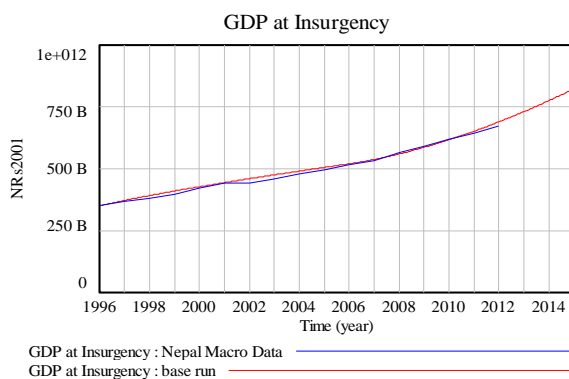


Figure 5.3: Base Run- GDP at Insurgency

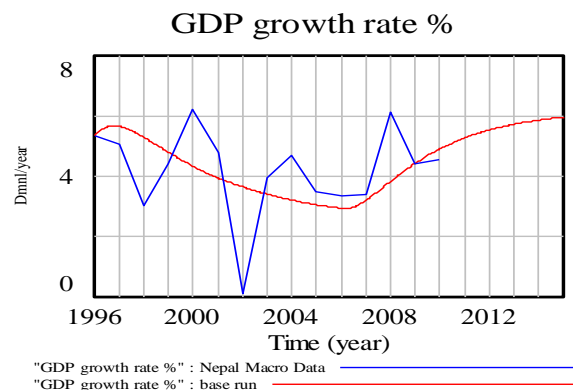


Figure 5.4: Base Run- GDP Growth Rate

5.3.2. Boundary Adequacy Test

This test assesses the appropriateness of the model boundary for the purpose of modeling. According to Sterman (2000) that modeler should use the model boundary chart, subsystem diagram, causal diagram, stock and flow diagram and direct inspection of the model equation to satisfy the adequacy of the model. Similarly expert opinion, interviews, archival material, and review of the literature should also be used to assess boundary adequacy of the model.

This test is a frame of modeling during the whole study. The model boundary chart shown in table 4.1 describes endogenous variables, exogenous and excluded variables in the model. The causal loop and stock and flow diagrams in Chapter Three and Four respectively describe model boundary in this study. Model equations checked thoroughly for exogenous input to confirm the list of exogenous variables. In this model, total cost of the insurgency excluded from the feedback the result of insurgency and counterinsurgency on economy and vice versa is designed in the model. Therefore, the feedback of the total cost of the insurgency excluded to avoid double count the result of the insurgency on economy.

5.3.3. Dimension Consistency Test

The dimension consistency tested directly by the software using to build and simulated for this study. In the case of logical equation to which software did not trace unit consistency, the effort paid to inspect equations one by one so as to build up confidence about unit consistency. Therefore, the model tested of the unit consistent.

5.3.4. Structure and Parameter Assessment

All of the structures based on the situation mentioned in the real world relevant to the design of the study. Focus has been paid not to violate physical realities. Causal diagram, stock and flow diagram and direct inspection of the model equation enhance confidence that the structure of the model in this study reveals the real life situation. The technique of modeling in the previous chapters is reasonable for this study, and the reader should evaluate the rest.

In the parameter assessment, this is a weak point of this model in term of parameter estimation. There are a number of parameters in this model such as time to join the insurgency, time to satisfy, time to dissatisfy, time to create pressure, attrition parameter, and maximum suppressive act that are inaccessible. Furthermore, some are different depending on the source mentioned. The parameters, however, estimated on the basis of past research work, reports and time series data and started conceptually to the realistic. Furthermore, sensitivity test results show that very few of them are sensitive to the performance of the model. The use of these parameters still keeps the model on track of study purposes, which is building a generic model independent to the parameter.

5.3.5. Direct Extreme Condition Test

The purpose of this test is to see how the system responds in some extreme condition. This test carried out by direct inspection of model equations and simulation so as to build confidence whether the model is robust in extreme condition. The parameters adjusted accordingly and simulated the model to satisfied robustness under extreme conditions.

Insurgent Parameter = 0 and 5

Insurgent parameter measures the power that modifies the effect of public satisfaction with the government and effect of public satisfaction with the insurgent on insurgent recruitment as shown in the figure 5.5 and 5.6.

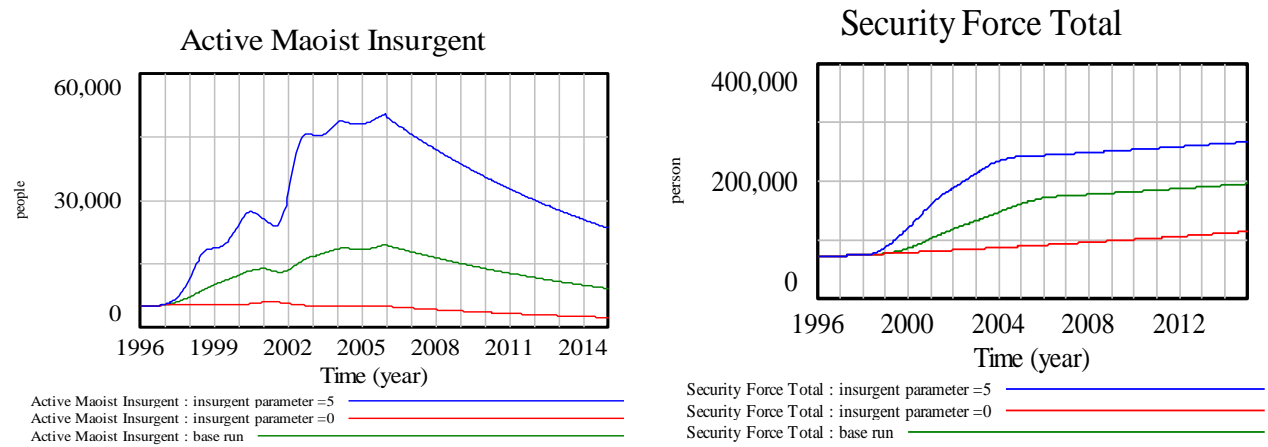


Figure 5.5: Active Moist and Security force Total when Insurgent Parameter=0 and 5

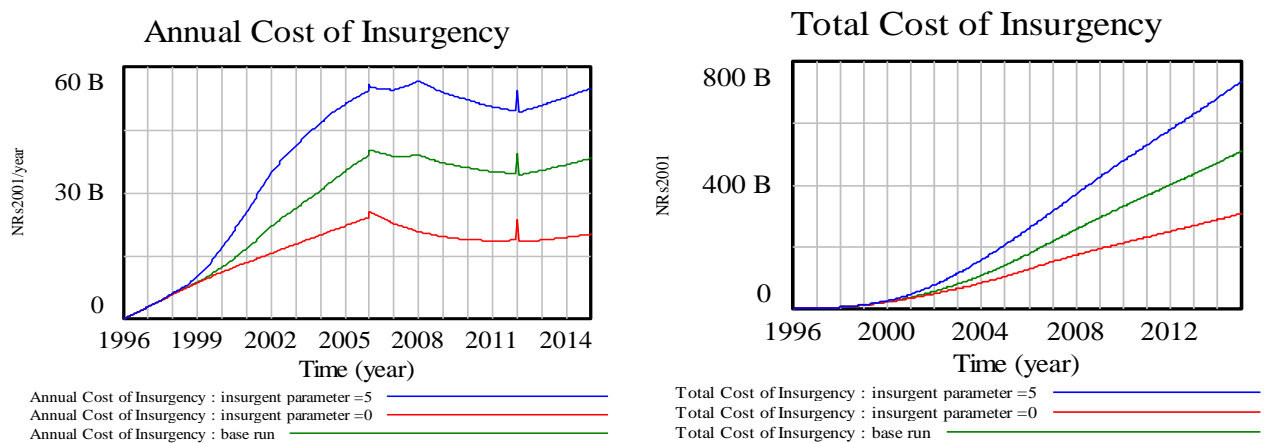


Figure 5.6: Annual Cost of Insurgency and Total Cost of Insurgency when Insurgent Parameter=0 and 5

Satisfaction parameter = 0 and 1

Satisfaction parameter measures sensitivity of peoples' perception about coercive acts by the security forces and the Maoist. It should be set to less than one to ensure diminishing returns to coercive acts.

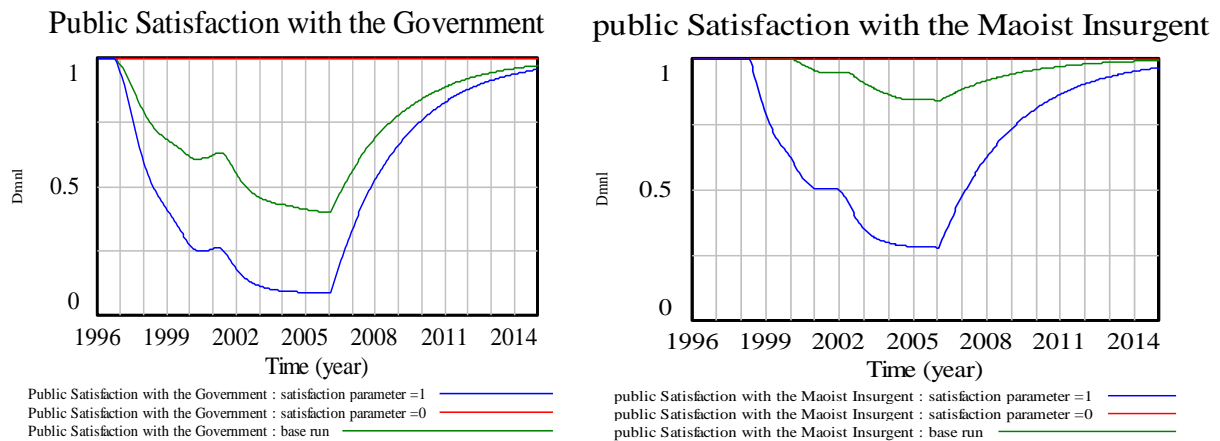


Figure 5.7: Public Satisfaction with Government and Maoist Insurgent if Satisfaction Parameter = 0 and 1

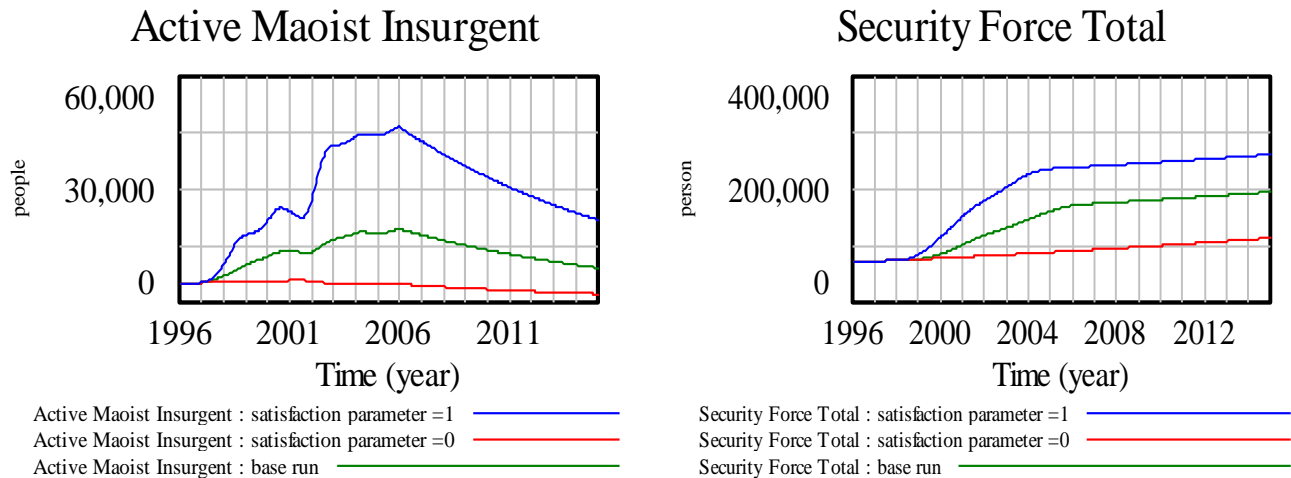


Figure 5.8: Active Maoist and Security Force Total if Satisfaction Parameter = 0 and 1

Public satisfaction is the key variable of insurgency dynamism and depends on the number of coercive acts of the conflicting actors. Dissatisfaction with an actor turned into support to another and vice versa.

Economic effect parameter =0 and 1

This parameter measures the sensitivity of the economic sector toward insurgency dynamics. The higher the value of this parameter leads to greater effect on the economy, therefore, lower the GDP and increase the cost of the insurgency. Similarly, weak performance of the economy has weakened state capacity to deal with the insurgency effectively in relation to attrition and recruitment. The figures below show the behavior while taking different value of this parameter.

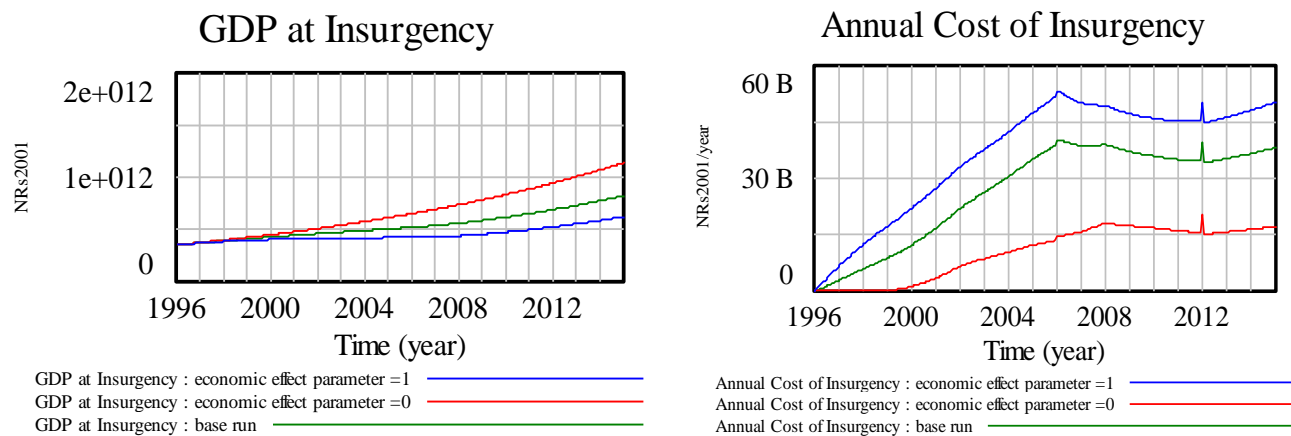


Figure 5.9: GDP at Insurgency and Annual Cost of Insurgency when Economic Effect Parameter = -0 and 1

Max suppressive acts = 0 and 1

This parameter is a limit on how many coercive acts a soldier could commit per year. The higher suppressive acts per soldier aim to reduce the number of insurgent, however, this also causes dissatisfaction with the government and leads to further growth of insurgent number as shown in the figure 5.10 and 5.11.

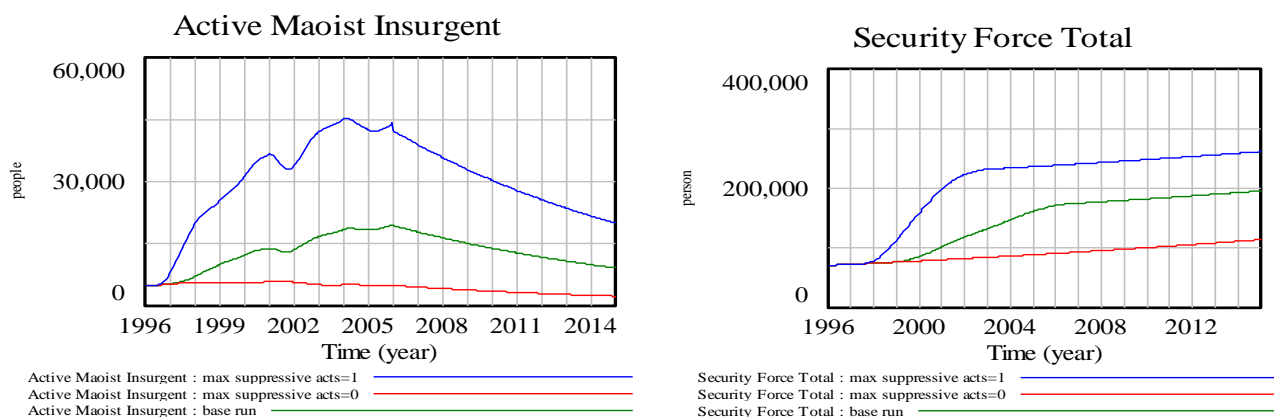


Figure 5.10: Maoist Insurgent and Security Force Total when Max Suppressive Acts = 0 and 1

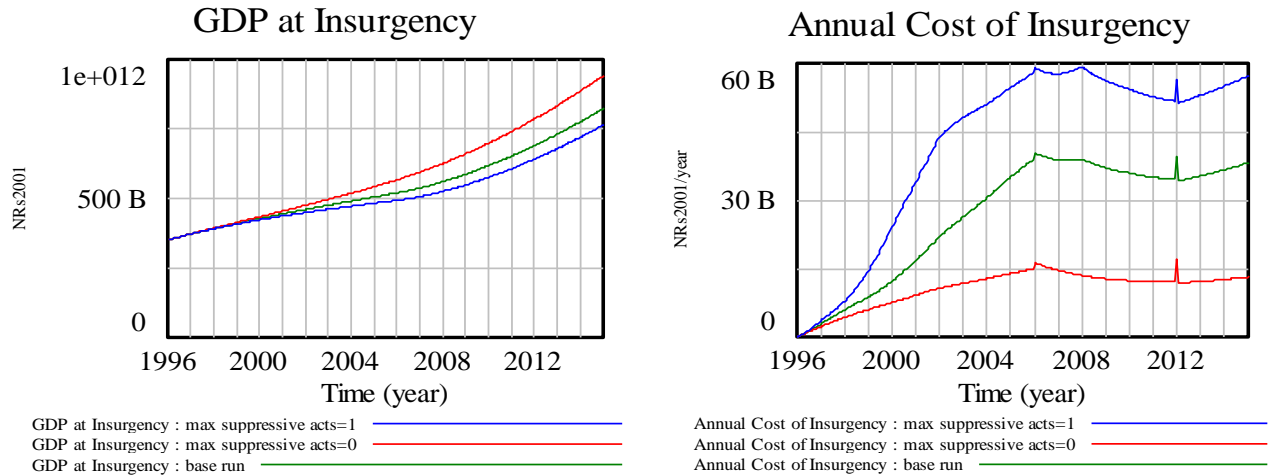


Figure 5.11: GDP at Insurgency and Annual Cost of Insurgency when Max Suppressive Acts = 0 and 1

Time to join insurgency =0.1 and 2 year

This parameter measures the time taken to recruit potential insurgent as a full time insurgent. The figure below shows the higher time taken in the recruitment will slow down insurgency dynamism in the system.

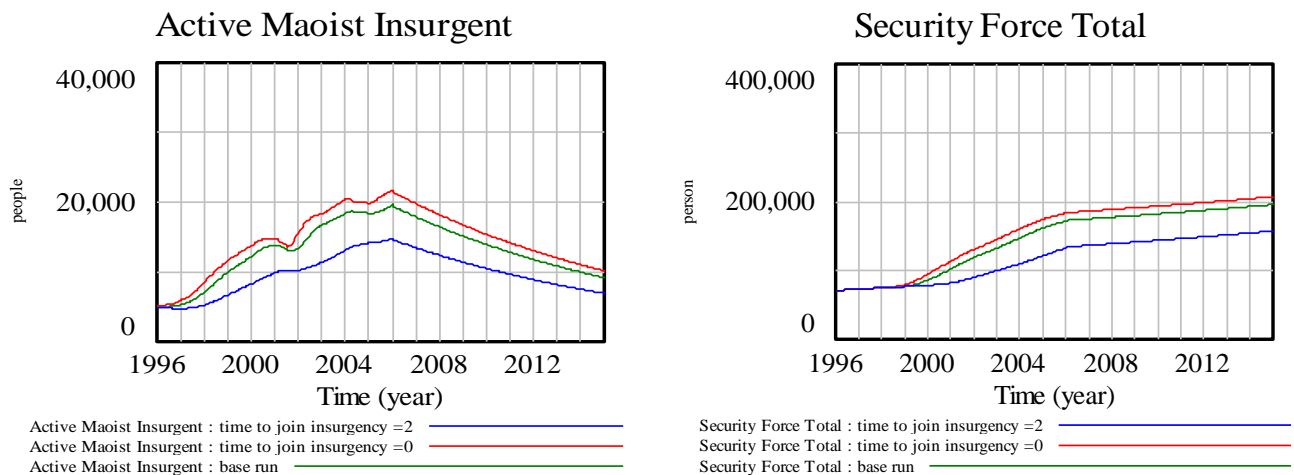


Figure 5.12: Maoist Insurgent and Security Force Total if Time to Join Insurgency = 0.1 and 2 year

Average insurgent career in years =1 and 20

Average insurgent career in years is the number of years an insurgent will be active assuming that he has not been captured.

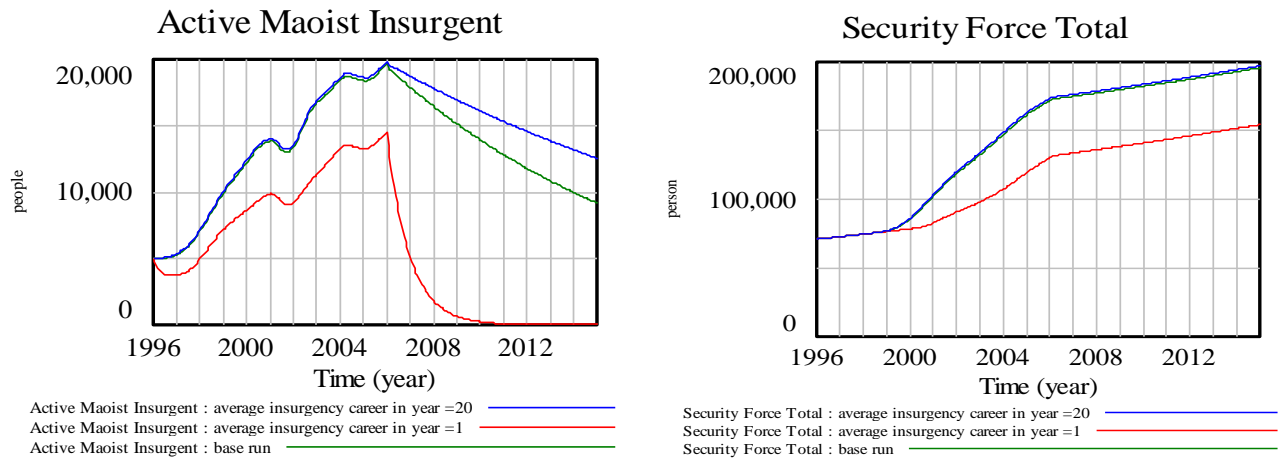


Figure 5.13: Maoist Insurgent and Security Force Total when Average Insurgent Career in Year = 1 and 20

Incidents per insurgent =0.01, 1 and 2

This parameter measures a limit on how many insurgent incidents an insurgent could commit per year. Insurgent incidents measure the degree of public satisfaction toward insurgent and pressure to reduce such incident for security forces. Higher insurgent incidents, on one hand, reduce public support toward the insurgent which affects their recruitment; on the other create pressure to use more security force. The insurgents could be in a favorable situation only when security forces committed greater coercive acts. Use of more or less coercive acts slows down their growth, but faster growth in opponent side as shown in the figure 5.14.

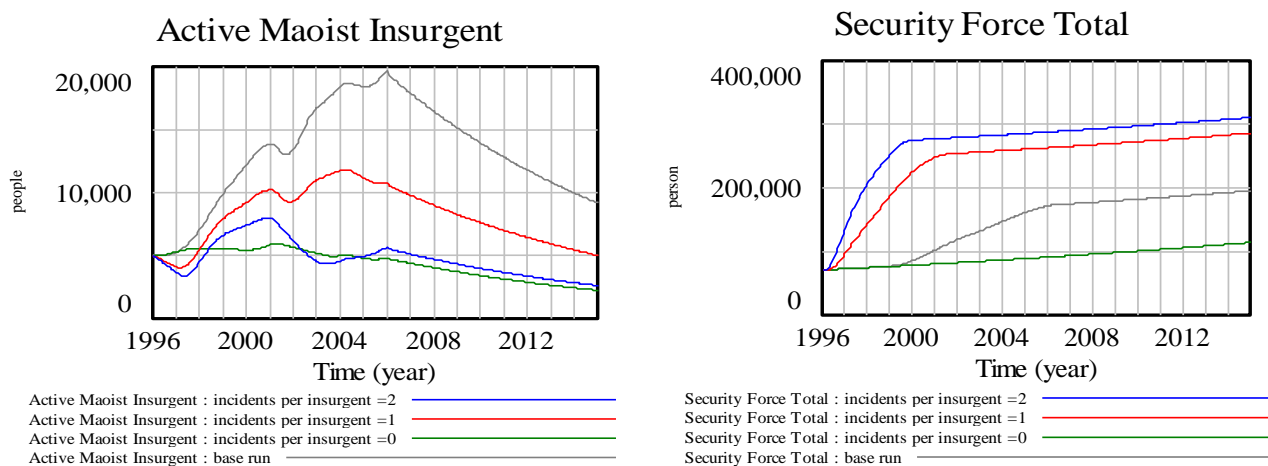


Figure 5.14: Maoist Insurgent and Security Force Total if Incidents per Insurgent= 0.01, 1 and 2

Both parties try to commit coercive acts in such a way not to diminish public support. There is a risk of losing public support in committing more coercive acts and risk of being arrested or controlled by an opponent in case of committing fewer actions.

Time to create pressure =0.1 and 10 year

Time to create pressure is the scaling factor for the result of incidents on pressure on the government. Short time to recognize pressure speeds up insurgency/counterinsurgency actions. That further deepens the insurgency dynamism because both parties could commit more violent actions.

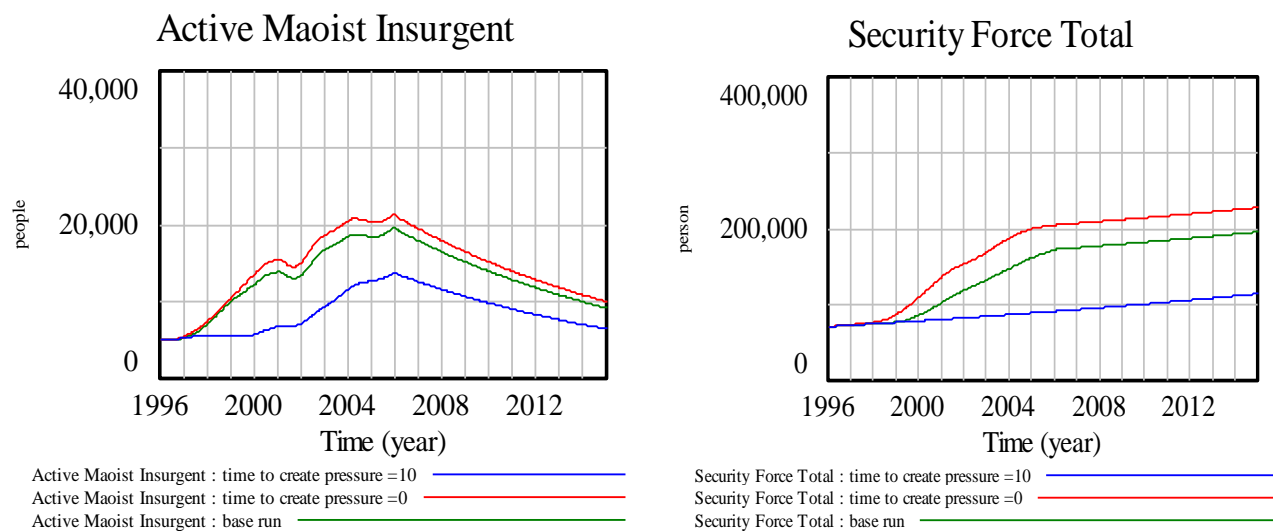


Figure 5.15: Maoist Insurgent and Security Force Total if time to create pressure = 0.1, and 10 years

Time to weary of insurgency =0.1 and 10 year

Time to weary of insurgency measures the desire of the government to pull back of security forces from the operation and try to settle disputes in a peaceful manner due to weariness with the insurgency. The higher the populace worries about the war, the fewer security forces they have to maintain in the operation.

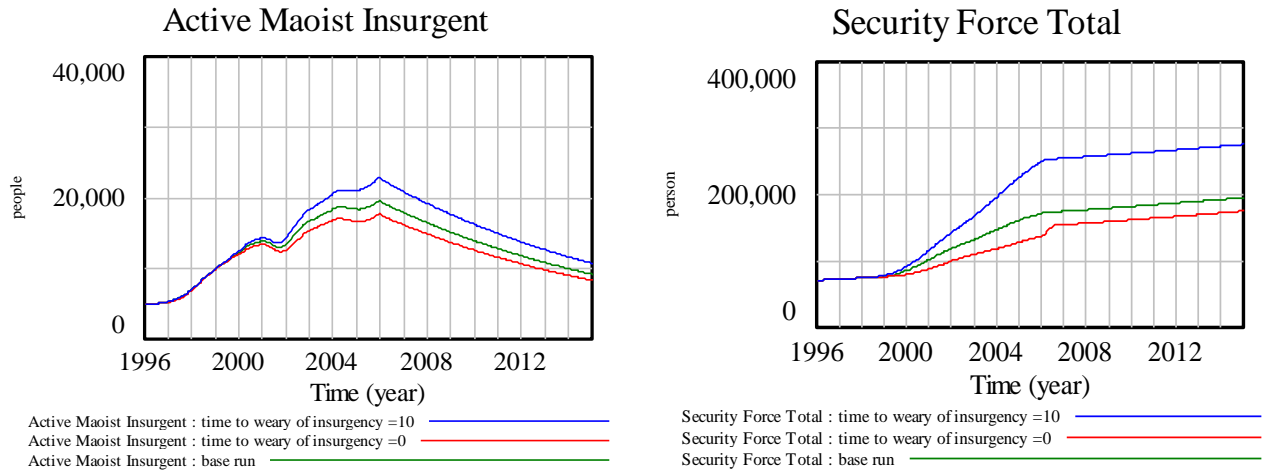


Figure 5.16: Maoist Insurgent and Security Force Total if time to weary of insurgency = 0.1 and 10 years

Time to satisfy = 1 and 5 years

This measure how long the public need to satisfy.

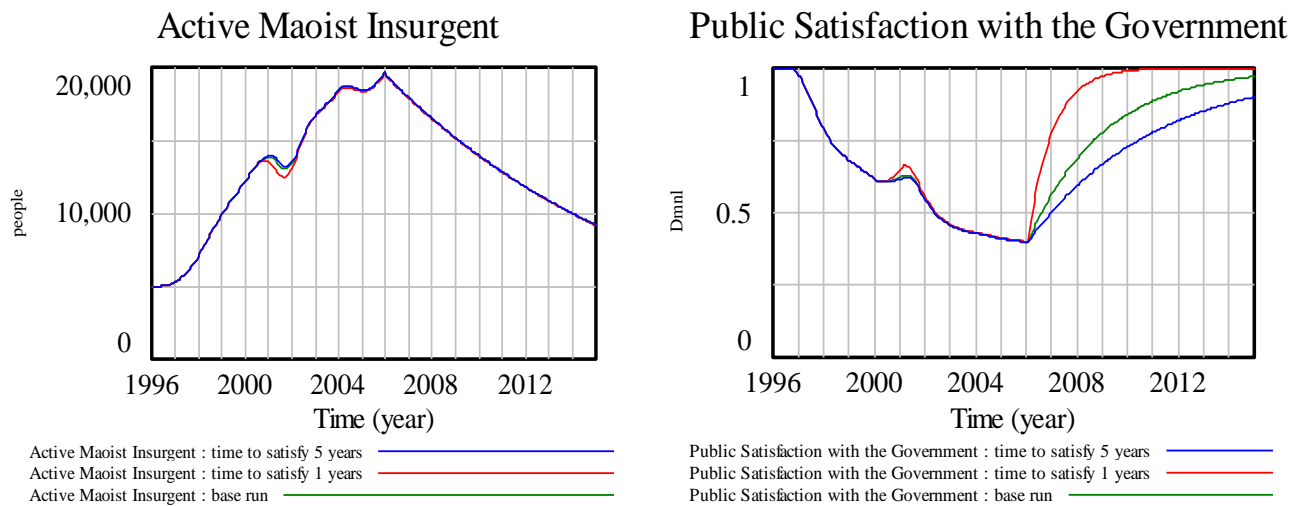


Figure 5.17: Maoist Insurgent and public Satisfaction with the Government if time to satisfy = 1 and 5 years

The figure above shows there is not much difference in satisfaction in initial stage, but difference can be seen at later stage.

Time to dissatisfy =0.5 and 5 years

This is the time needed to upset people. Longer time to upset people affects insurgent recruitment, therefore, slow down the insurgency activity.

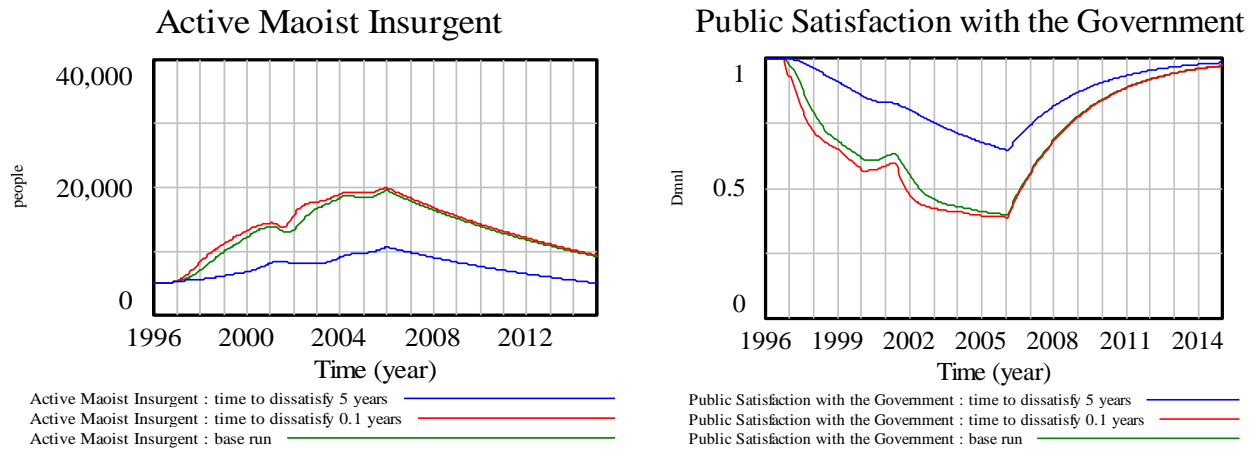


Figure 5.18: Maoist Insurgent and public Satisfaction with the Government if time to dissatisfy = 0.5 and 5 years

5.3.6. Sensitivity Analysis

Sensitivity analysis is a key step in the modeling process, especially when the model contains highly uncertain parameter (Ford, 2010). This test aims to ensure that the uncertainty in many parameters does not make much difference in the result. In this study numerical and behavior sensitivity analysis conducted to see whether the function variables used in the model are sensitive for the model.

Effect of war Weariness and Pressure to Reduce Incidents on Desired SF: The graph lookup function tested by changing the behavior. The normal use (base run) is an exponential decay for the effect of war weariness and exponential growth for the effect of pressure to reduce incidents on desired security force. For the test, the graph lookup changed in the s-shape pattern as shown below in the figure.

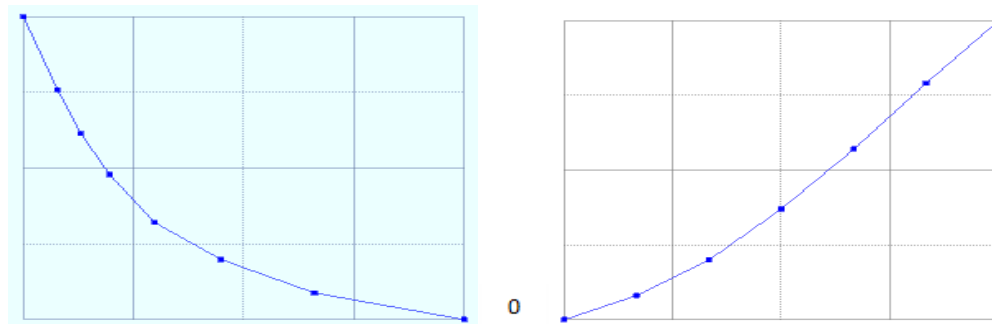


Figure 5.19: graph lookup: - effect of war weariness and Pressure to reduce incidents exponential pattern

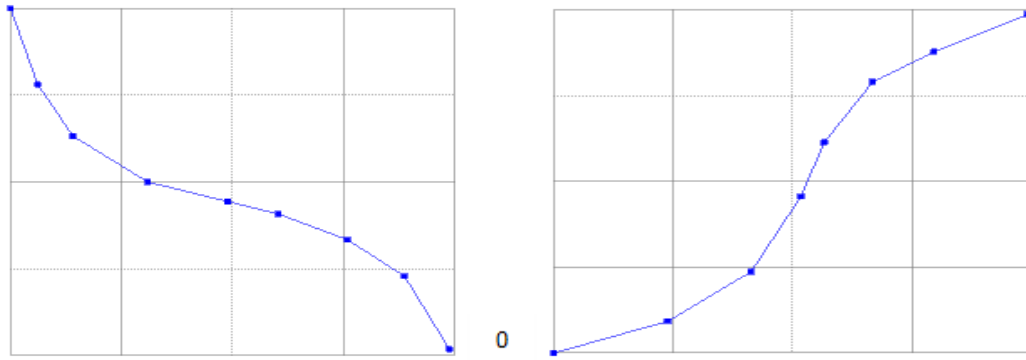


Figure 5.20: graph lookup: - effect of war weariness and pressure to reduce incidents s-shape pattern

The result of the simulation in the Figure below shows that there is not much difference between simulations. Therefore, the model is not sensitive to the graphical function.

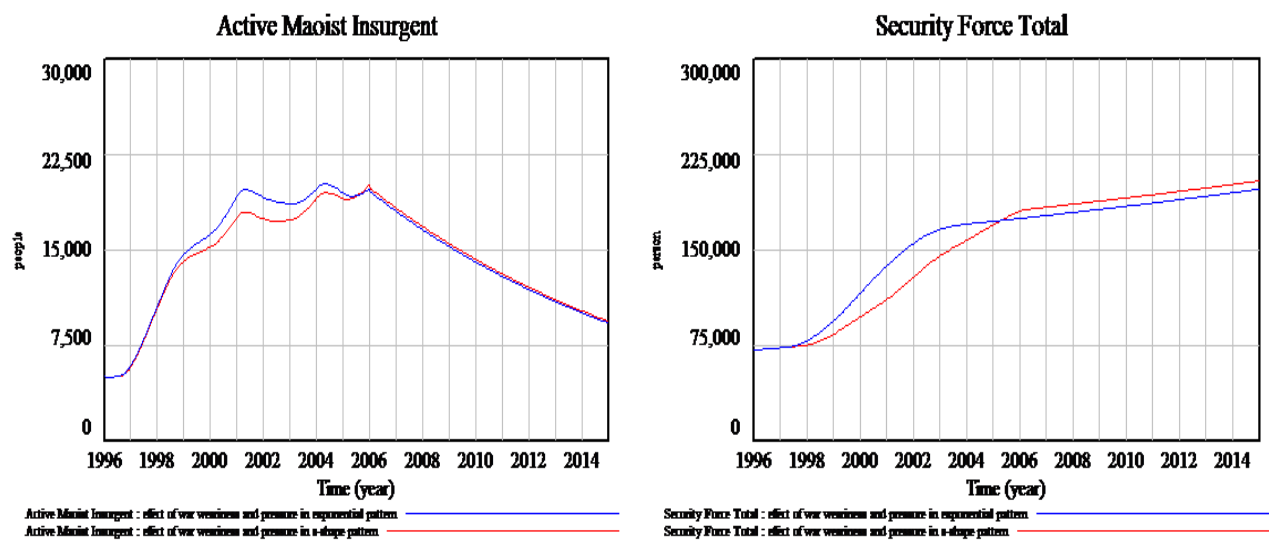


Figure 5.21: Active Maoist and Security force taking exponential and S-shape graphical function

Adjustment Time Sensitivity: For this test, adjustment time of variables such as time to weary of insurgency, time to create pressure, time to satisfy, time to dissatisfy, average insurgent career, time to join the insurgency, suppression response time, adjustment time of economic effect, weapon and resource depletion time set by the range of $\pm 50\%$ and $\pm 100\%$. The figure below presents the results of sensitivity analysis.

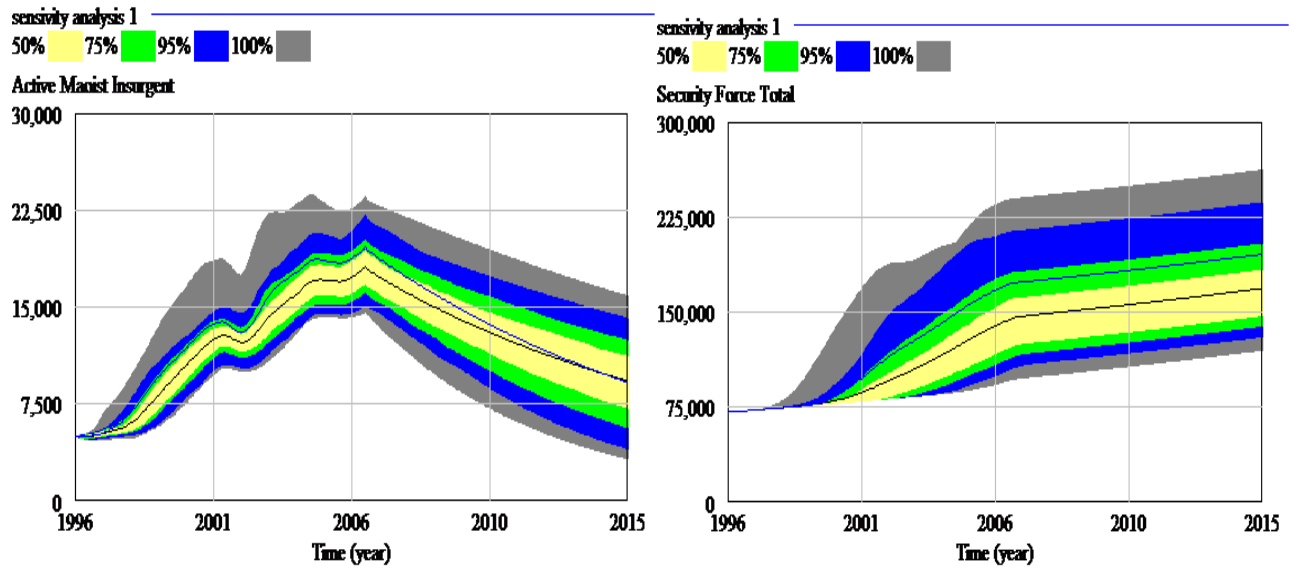


Figure 5.22: Time sensitivity: Active Maoist and Security force Total

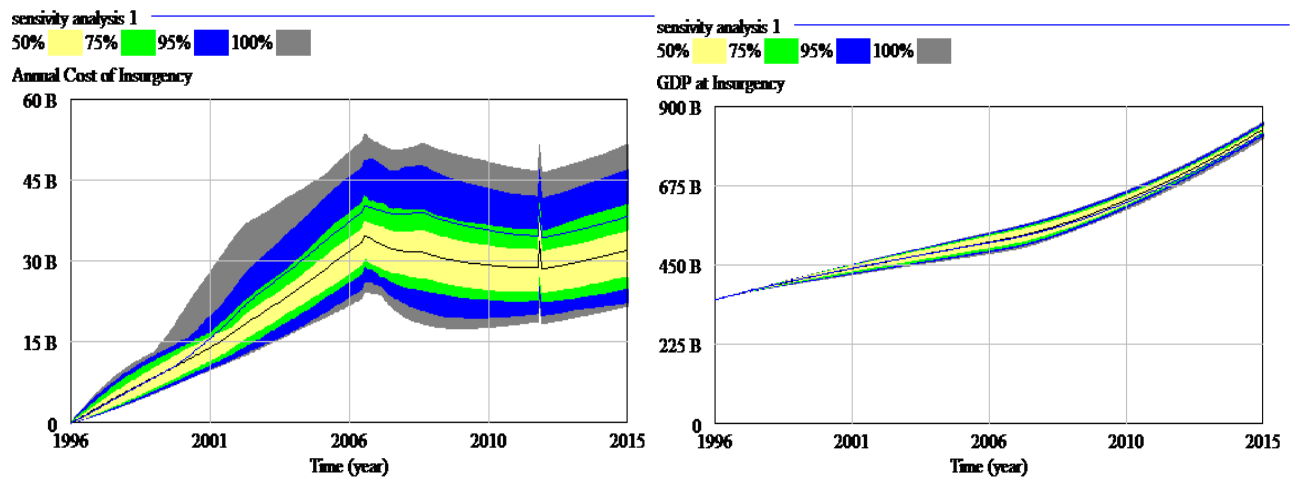


Figure 5.23: Time sensitivity: Annual Cost and GDP at Insurgency

The simulation result shows that the change of these variables does change the model behavior in some instant.

Parameter Sensitivity: The value of the parameter such as the attrition parameter, SF resource parameter, insurgent parameter, satisfaction parameter, economic effect parameter, suppressive parameter, maximum suppressive acts, and reference incidents set by $\pm 50\%$ and $\pm 100\%$. The result of parameter sensitivity has shown below in the figure.

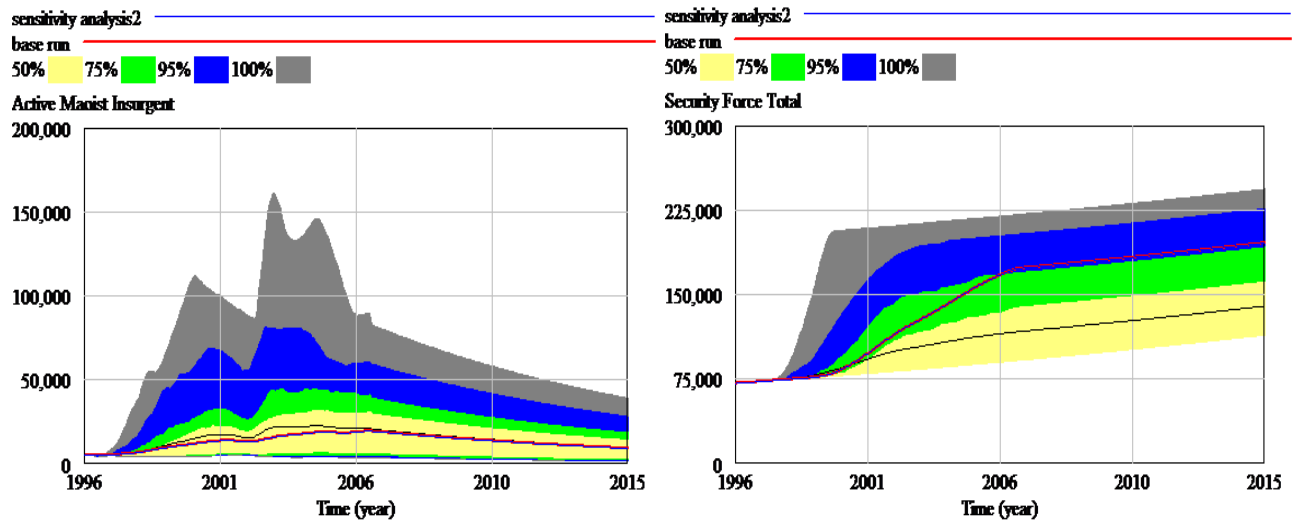


Figure 5.24: Parameter sensitivity: Maoist Insurgent and Security Force Total

War Weariness Sensitivity: For this test, time taken to be worried about insurgency is set by $\pm 50\%$ and $\pm 100\%$ to see a change in the behavior of the model variable. The result below shows that time to be perceived the negativity of insurgency has significant influence on the behavior.

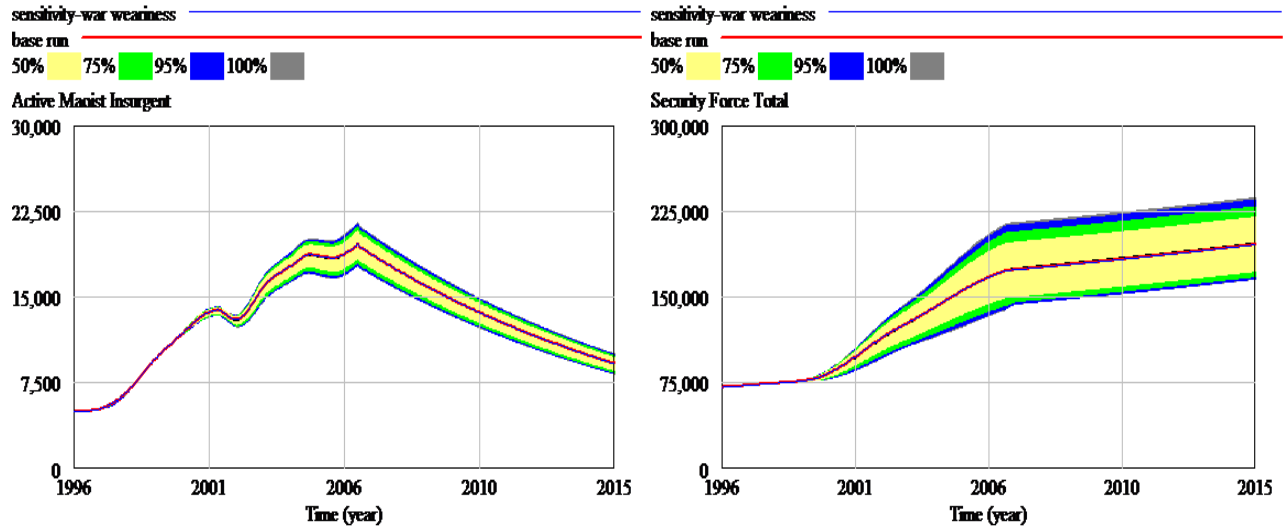


Figure 5.25: War weariness sensitivity: Maoist Insurgent and Security Force Total

Pressure to Reduce Incidents Sensitivity: Time to perceive pressure to reduce insurgent incident set by $\pm 50\%$ and $\pm 100\%$. The result below shows sensitivity of model behavior while changing the assumption about the time taken to recognize pressure.

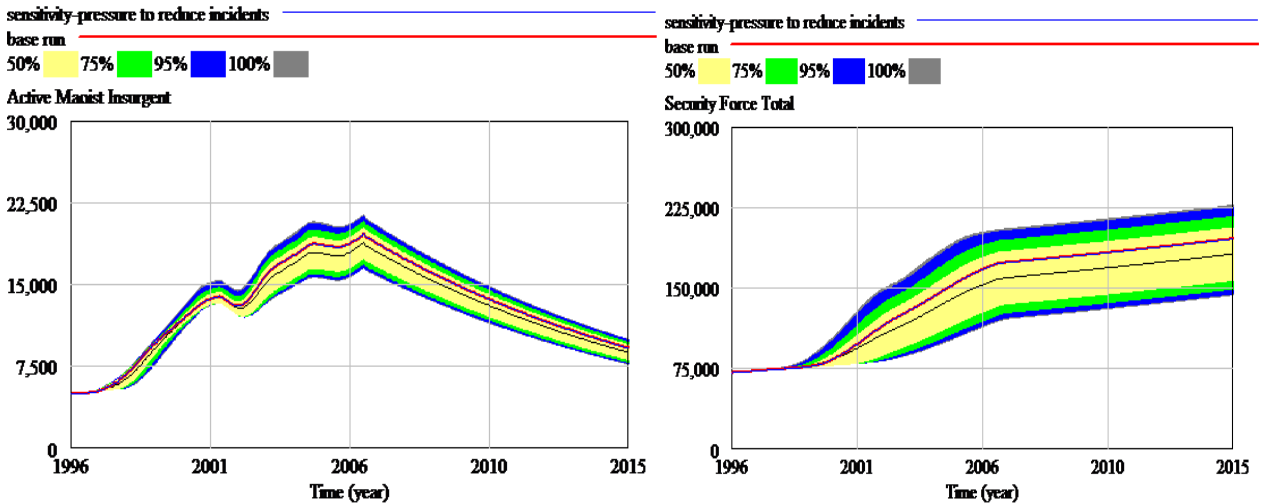


Figure 5.26: Pressure to Reduce Incidents sensitivity: Maoist Insurgent and Security Force Total

Satisfaction Parameter Sensitivity: Satisfaction parameter is an important determinant of people's satisfaction toward the government and insurgent. This parameter set by $\pm 50\%$ and $\pm 100\%$ to see a change in model behavior. The result below shows that change in the assumption of this parameter has significance impact on the change in model behavior.

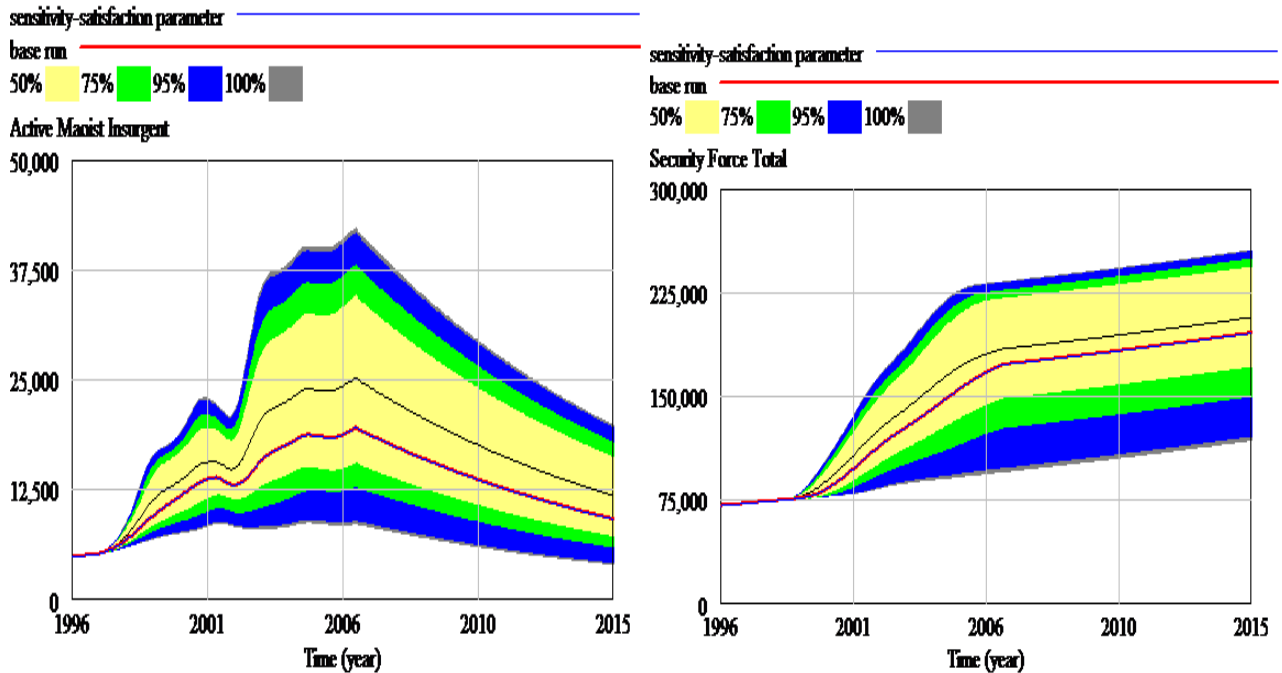


Figure 5.27: Satisfaction Parameter sensitivity: Maoist Insurgent and Security Force Total

5.3.7. Integration Error

The time step using in the model should be suitable for the model. For the base run simulation the time step has taken as 0.0625 year. In this test, the time step tested by cutting down for half of the initial then simulate the model to see whether the behavior of the model change or not. If the time step used is suitable for the model, the behavior should not be distinct from the base run. By this testing process, the used time step is 0.03125 year and then changes the time step to 0.125. The model still keeps the same behavior as started. Therefore, the time step using is suitable, and the model is not sensitive to time step.

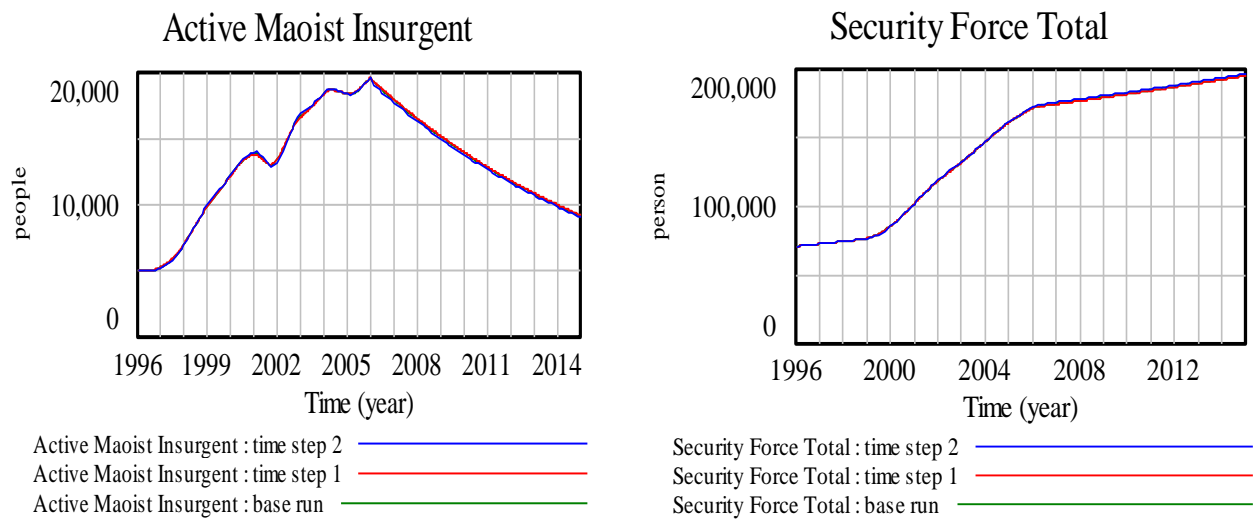


Figure 5.28: Integration Error: Maoist Insurgent and Security Force Total

5.4 Summary

The structure and behavior of the model tested by a number of methods and the corresponding results presented in this chapter. For the scenario, further test will be conducted in the next chapter. Nevertheless, in this chapter, not all tests can be done but the study chose the tests, which make satisfaction of the model structure and behavior within the frame of study and design purpose. The model passed all the tests applied. The model behavior is sensitive to some of the parameters and not sensitive to some other parameters. Some parameters compensate other parameter value to generate particular behavior of the model. By these results, therefore, it can be concluded that the model is acceptable for this study.

Chapter Six: Scenario and Discussion

6.1 Introduction

In Chapter Five, a number of model validation tests have conducted so as to enhance reliability of any model. It is important to verify and validate the model before simulating different scenarios and making policy suggestions about it. The general form of the model and relevant structure used as tools of simulation and demonstrated how the general model can be used to investigate insurgency dynamics and associated costs of insurgency.

In this Chapter, the model developed and tested will be used to simulating the base case and introduce alternative assumption about different scenarios. Assumptions in different scenarios will be further tested and analyzed before suggesting possible alternative strategies as treatments to the insurgency management. This chapter aims to derive the basis for policy or strategy suggestion for a better insurgency management.

Base run scenario explains structure, strategy and variable responsible for what happened in the past during insurgency. This scenario is designed to capture the possible impact of the actors' actions, the people's perception, the economy, and the costs in the insurgency dynamics. The simulation result is compared with the reference data. The considerations are based on insurgent incidents and security force counter actions.

Scenario one, if the impact of the economy on insurgent and security force activity is assumed not to influence the insurgency dynamics what will be happening to intensity of the insurgency and its cost.

Scenario two, if the population is considered as static and taken as exogenous input of the population of 1996 then what difference does it make for the insurgency dynamics and the cost.

Scenario three, if the public satisfaction is not considered as part of the system or if actors' activities do not affect the level of public satisfaction and still is in the same level as before, what would happen in the insurgency dynamics and cost of conflict.

Scenario four, if insurgent and security force have unlimited resource capacity to involve in the conflict i.e. if resource constraint does not have any influence on insurgent and security force activity then how would the system (insurgency dynamics) develops behavior and its associated cost over time.

Scenario five, if the incident suppression loop is switched off and considered no offensive actions by the security forces, then how would the insurgency dynamics reacts and changes in the cost of the insurgency. In this situation, how the system should prevent the state from being captured by the opponent.

Scenario six, if the insurgent creation loop is switched off and there is no insurgent recruitment during insurgency, what could be the intensity of conflict and its cost.

Scenario seven, if the war weariness is switched off and is not considered as part of the system, how would insurgency dynamics evolve and generate its cost over time. Similarly, if the time to weary of insurgency varied what different it produce in the insurgency dynamics and its associated cost.

Scenario eight, the hidden cost of conflict is considered to calculate after the insurgency cost. The hidden cost added to this scenario shows how the cost of conflict grows in the long run.

6.2 Scenarios

6.2.1 Base scenario: Reference Mode

The base scenario presents the insurgency dynamics and its associated cost which runs under the hypothesis of lack of understanding of insurgency development and mitigation has contributed to the cost of the conflict. The model structure developed in Chapter four is used to simulate the dynamic behavior of insurgency. The simulated behavior is compared with reference data presented in section 5.3.1 so as to build confidence about structure, variable and parameter responsible for generating such behavior. This section shows additional result of the simulation relating to the base scenario. Strategies or policies suggested in this research are based on a comparison with the base scenario. The annual cost of insurgency and total cost of insurgency in the base scenario is presented in figure 6.1.

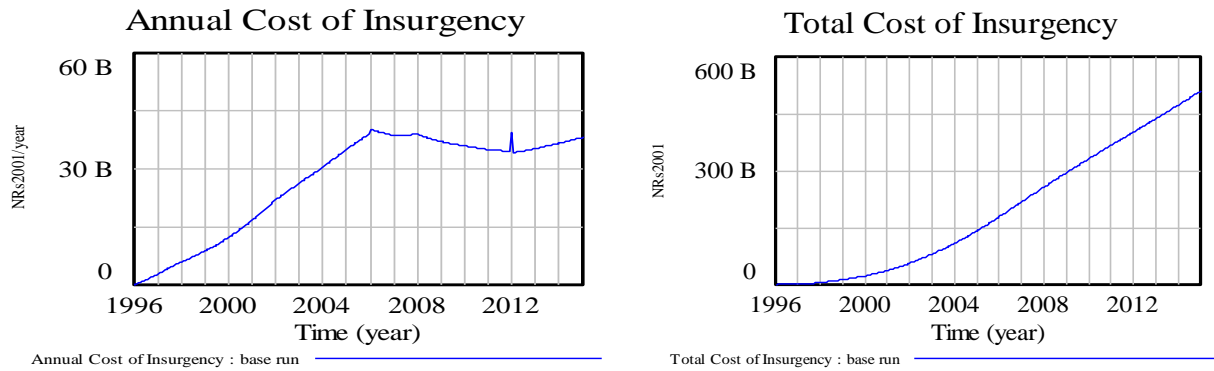


Figure 6.1: Base Scenario: - Annual Cost of Insurgency and Total Cost of Insurgency

Annual cost increased every year when insurgency started in 1996 and continued to grow until ceasefire agreement between the government and the insurgent signed in 2006. Thereafter the cost slightly decrease till the process of integration of the Maoist combatant into security force has completed in 2012. The annual cost of conflict does not end to this point, because hidden cost and indirect cost still contributing to this cost. The accumulated cost shown in the graph named total cost of the insurgency shows the behavior of cost as approximately linear growth.

6.2.2 Scenario One: Insurgency and State Capacity

In scenario one, the environment of insurgency dynamics will be changed by manipulating the effect of state capacity in the insurgency dynamics. In line with this assumption, the link between economy sector and insurgent/security force activity sector is switched off and also used the different value of state capacity to see model behavior and compared with base run scenario.

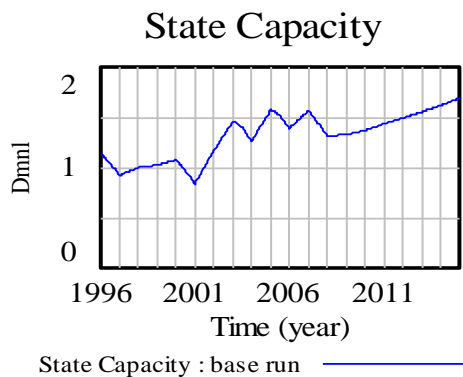


Figure 6.2: State Capacity: -base run

State capacity, as discussed in the chapter three, is the function of economic performance, regime legitimacy, political capacity and social capacity. Polity index, civil liberties index, GDP index, employment index, literacy index and the governance index are taken as the determinants of state capacity. GDP index assumed as an endogenous variable depends on the growth of GDP from economic sector, and other indices are considered as exogenous

variable using time series data from different sources. The figure 6.2 above shows the state capacity index in base run scenario.

The impact of state capacity assumed in this study as; effect on insurgent recruitment, security force resources and potential economic effect. The simulation result in figure 6.3 and 6.4 explains the change in behavior when state capacity value assume as constant one compared to base case scenario in which it varies 0.75 to 1.75.

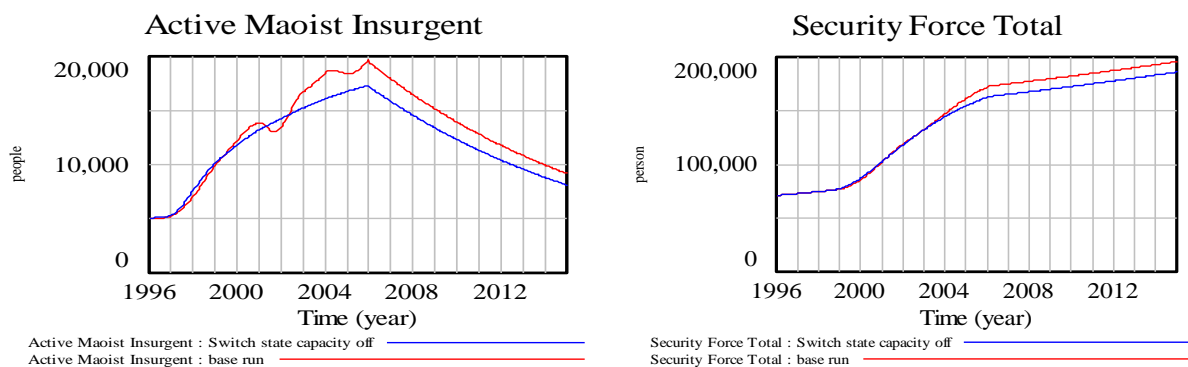


Figure 6.3: Insurgency and State Capacity: - Maoist Insurgent and Security Force Total

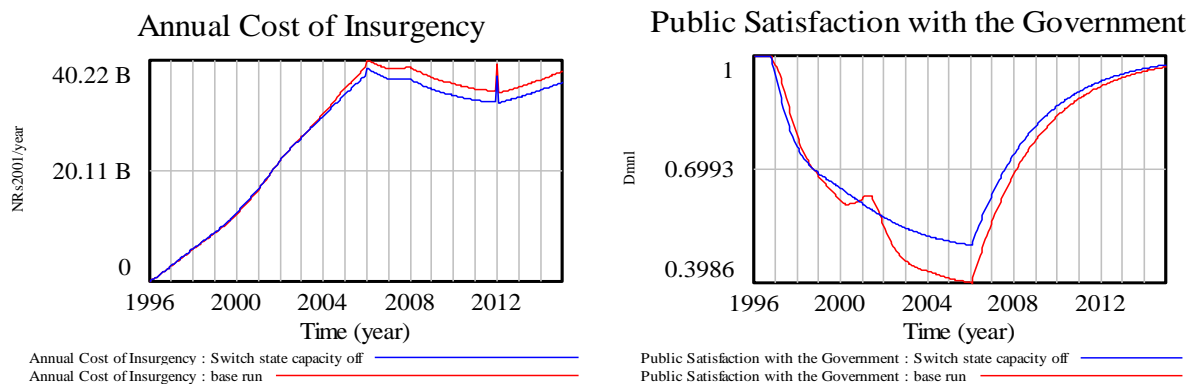


Figure 6.4: Insurgency and State Capacity: - Cost of Insurgency and Public Satisfaction with the Government

The greater state capacity reduces, on the one hand, possibility of insurgent recruitment by compensating adverse effect of dissatisfaction of people toward the government and on the other it ensures sufficient resources to conduct security force activities. Similarly, greater state capacity compensates the adverse effect of insurgent/security force activities on the economy that further improves state capacity. When state capacity is switched off, the intensity of conflict

slows down, therefore, reduce the cost of conflict. It is because level of public satisfaction improves due to less suppressive actions by security forces. The impact of state capacity further tested by assuming different value of state capacity index as 0.1, 0.5, 0.75, 1.5, 2 and 5, the growth of active Maoist Insurgent and cost of insurgency shown in figure 6.5.

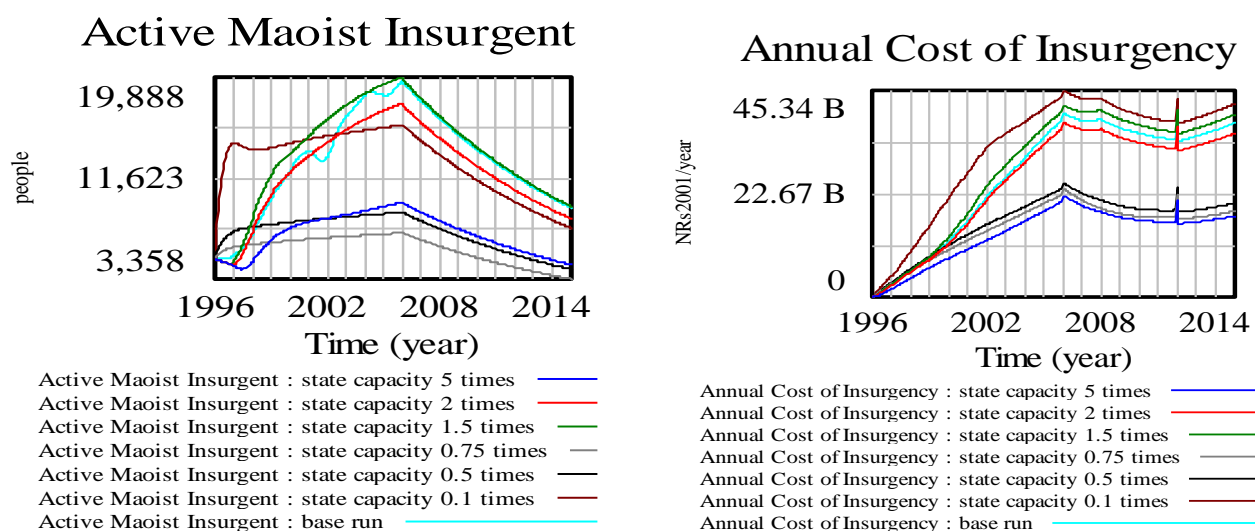


Figure 6.5: Insurgency and State Capacity: - Active Maoist Insurgent and Annual Cost of Insurgency

Low intensity of conflict can be seen when state capacity is above two and between 0.5 and 0.75 times. The high intensity of conflict is noticed when state capacity lies below 0.5 and between one to two times. Strong state capacity ensures the government ability to control situation, therefore, reduce the intensity of conflict. Very weak state capacity benefited to the insurgent recruitment and ability to commit incidents, therefore, increase the conflict. Cost of conflict is directly associated with a number of insurgent/security force and their activities.

It can be argued from the above discussion that the government should focus on strengthening state capacity component such as governance, employment, literacy, human right so as to prevent people from supporting insurgency. Similarly, strong state capacity ensures government ability to manage conflict effectively. There is a dilemma in people's perception during insurgency. On the one hand, people sought for security when insurgent commit violent incidents, on the other hand, greater use of force turned into dissatisfaction toward the government. In such situation, even the state has sufficient resources to combat insurgency; there actions should be very careful.

6.2.3 Scenario Two: Insurgency and the Population

In the base scenario, time series data of population from 1996 are taken to capture the dynamics of population. In scenario two, the static data of population of 1996 is taken to comparing the difference in insurgency dynamics and its cost. The figure 6.6 shows how dynamics of population describes insurgency dynamics.

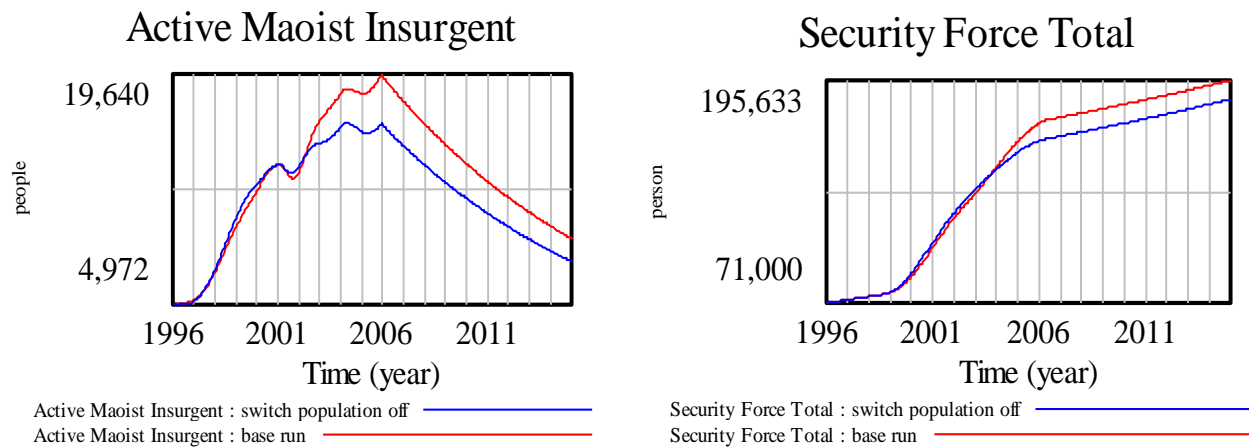


Figure 6.6: Insurgency and the Population: - Active Maoist Insurgent and Security Force Total

This scenario assumes that the more the size of population, the greater the possibility of having more conflicts in the country. It is because, the number of potential insurgent increased with the increment in population stock. Insurgent and security force both paid greater effort to influence more people on their side. These activities deepen the insurgency. The figure 6.6 clearly shows that when taking population of 1996 as constant, the insurgent number and security force fewer than the base scenario.

The population, as discussed in Chapter Three, is in the center of gravity in this model, both state and counter state rely on the population for recruitment, shelter, intelligence and other support. They pursue their action for gaining popular support. Populace should be considered neutral and coercive supporter may not consider insurgent until they give clear support to the insurgent. Population support or oppose state or counter agent by providing information. The number of population is a key constant to measure the effect of actions, resource collections and GDP index in the model.

6.2.4 Scenario Three: Insurgency and Public Satisfaction

Base case scenario evaluates the possible impact of public satisfaction in insurgency dynamics. Public satisfaction with the insurgent and the government is the function of their actions during insurgency. In this scenario three, it is assumed that actor's activities do not affect the level of public satisfaction. The satisfaction still is in the same level as before. The figures below present the result of the simulation and compare with the base case. Red line represents the simulated behavior when satisfaction with insurgent switch off, blue line satisfaction with the government switch off and green line represent base scenario.

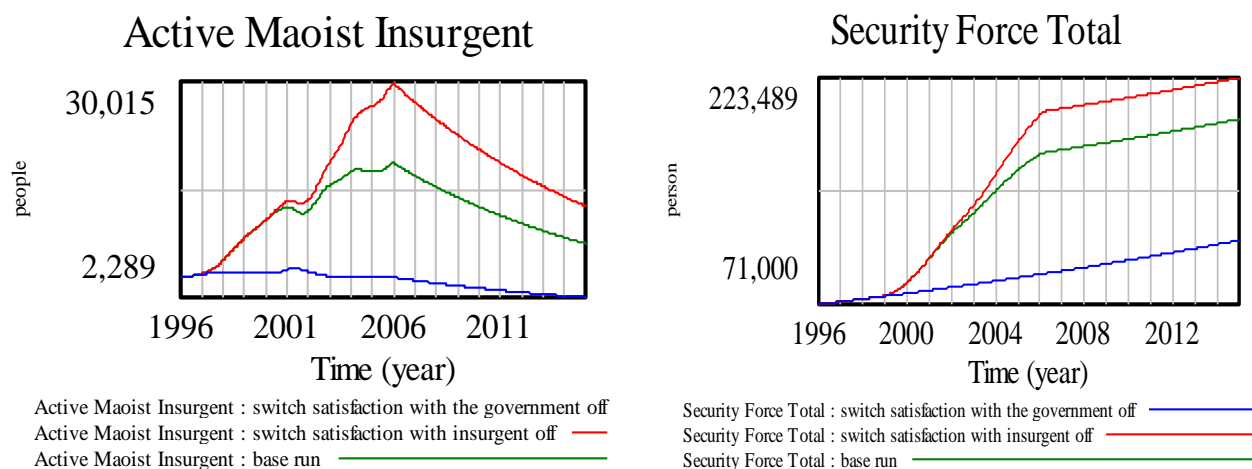


Figure 6.7: Insurgency and Public Satisfaction: - Active Maoist Insurgent and Security Force Total

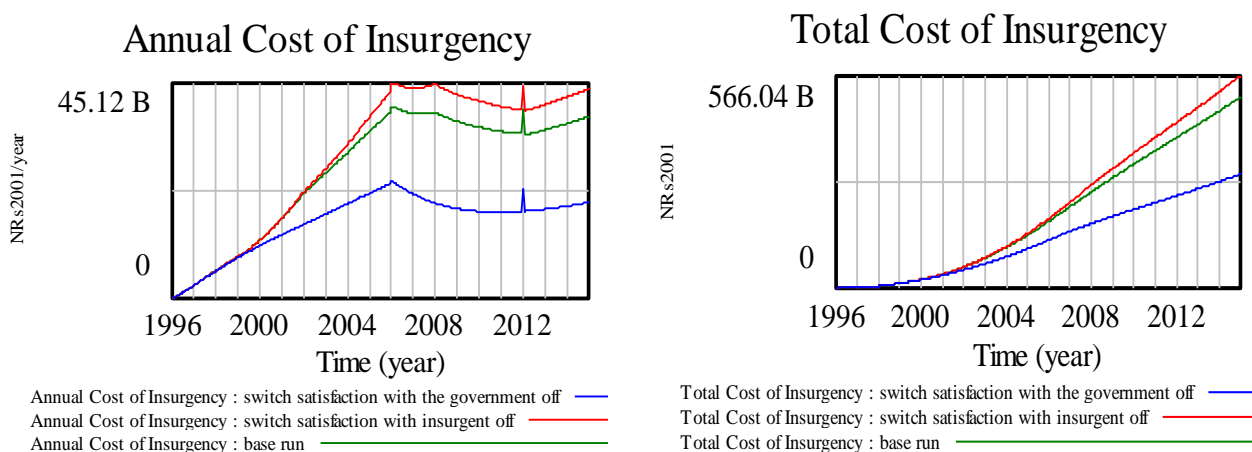


Figure 6.8: Insurgency and Public Satisfaction: - Annual Cost of Insurgency and Total Cost of Insurgency

The figures 6.7 and 6.8 show that the cost and the number of insurgent and security force grow remarkably when satisfaction with insurgent does not consider as the influence in insurgency dynamics. It is because insurgent incidents do not create an adverse effect on their recruitment through dissatisfaction of people. On the other hand, the number of insurgents reduced almost to zero, and the cost also decreased when public satisfaction with the government is switched off. It is because it does not support to the insurgent recruitment in the system, but continue decreasing their number through attrition and retirement. This scenario explains why the actors need to launch their coercive action without compromising public satisfaction.

As discussed in chapter three, how people perceive their activities and to what extent these activities interfere people's daily life determines public satisfaction or dissatisfaction toward the actors. Security force seeks support for intelligence to identify legitimate target. Similarly, insurgent need support to collect resource, employees and shelter. Public satisfaction measures the level of support or opposition to the actors. Dissatisfaction of people with one group favors the other and vice versa. Public satisfaction is the major engine of growth of insurgency dynamics. In this view, it is clear that the satisfaction of people is crucial to parties in the conflict. Both the insurgent and security force apply strategy to gain control and support of people. So, the government should always take into account public satisfaction even actions are in necessity.

6.2.5 Scenario Four: Insurgency and Resources

Both Insurgent and security forces require weapons, accessories and financial resources for their actions. The state to some extent, as a legitimate actor, has a benefit over the Maoist in relation to resource collection. The Maoist heavily relies on an internal source mainly include donation, extortion and other unpopular means of coercion. These resources collection activities and their impact on insurgency dynamics are modeled in base case scenario.

This scenario four assumes that the insufficiency of resources does not matter in the insurgency dynamics and see how the behavior differs with the base case. If both insurgent and counterinsurgent are free of tension about resources, the dynamics of conflict even deepen and the cost of conflict will further increases as shown in figure 6.9 and 6.10.

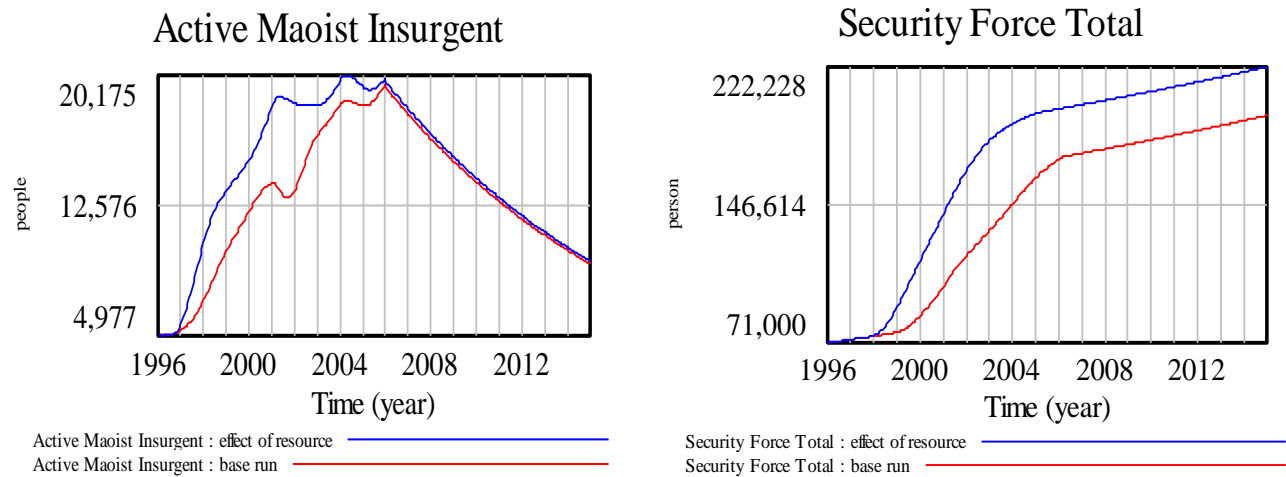


Figure 6.9: Insurgency and Resources: - Active Maoist Insurgent and Security Force Total

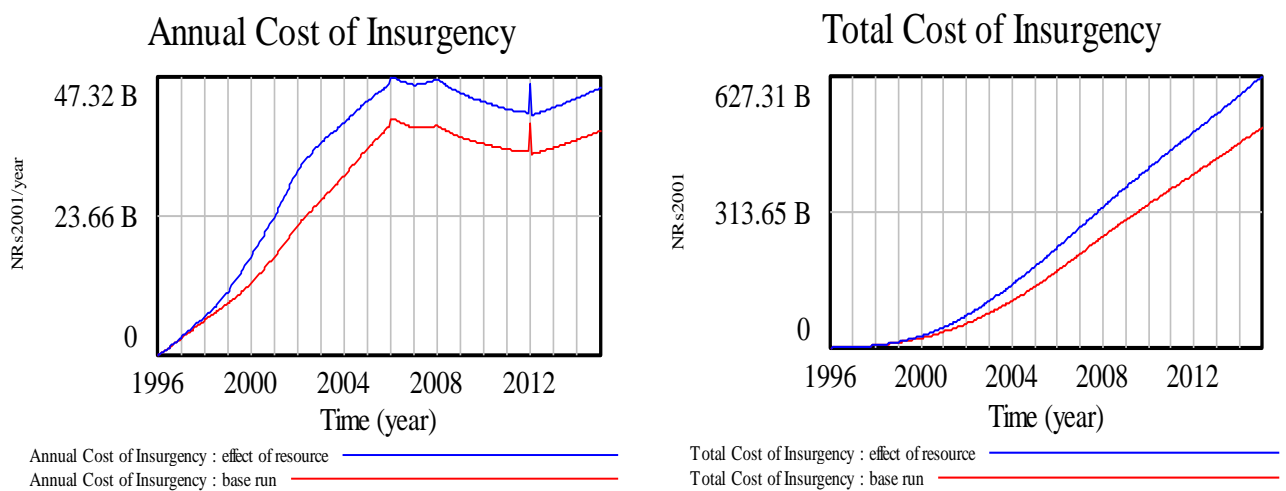


Figure 6.10: Insurgency and Resources: - Annual Cost of Insurgency and Total Cost of Insurgency

However, insufficient or excess resource reduces the intensity of conflict. Under this assumption, resource capacity of both insurgent and security force is tested by taking the value of 0.5, 2, 3 and five times. Inadequate resources limit their activities; therefore, intensity of conflict decreased in a significant level. Sufficient resource deepens conflict at beginning, but after some point the conflict intensity decreases. It is because sufficient resources support them to commit more insurgency and counterinsurgency activities that affect public satisfaction against them. The simulation result presented in figure 6.11.

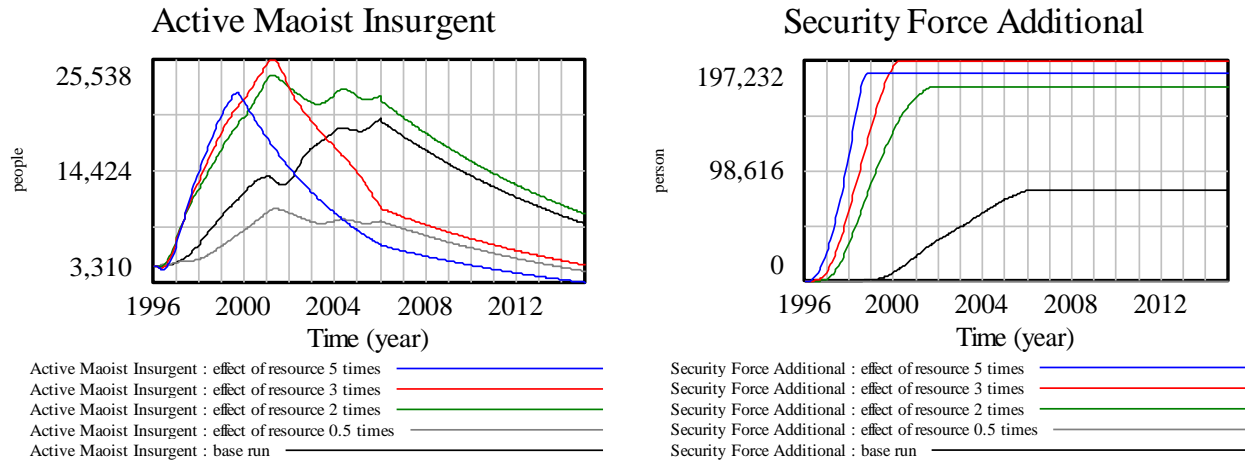


Figure 6.11: Insurgency and Resources: - Active Maoist Insurgent and Security Force Total

The aim of actors involved in the conflict, as discussed in chapter three, is to gain control and support of people, destroy opponent's resources and improve international relationship. They collect funds through various means- popular and unpopular. Tax imposes, and coercive collections are unpopular ways that deteriorate their image in front of people. The Maoist mainly involves coercive collection during insurgency. Excess resource collection may not support them always. So, they should collect resource in such a way that do not create excess burden to the people.

6.2.6 Scenario Five: Insurgency and Incident Suppression

Base scenario describes how security force mobilized to control insurgent activities during insurgency. Insurgent incidents upset people, and they pressurize government to take action to stop such incidents. Use of coercive power reduce insurgent activities in the short run, but in the long run it activate insurgency creation loop due to an adverse effect on public satisfaction toward the government.

The scenario five presents the idea that how the model behavior differ with the base scenario if the government does not involve in offensive acts. Incident suppression loop is switched off to cut off security force offensive actions. Then see how would the insurgency dynamics reacts and changes in the cost of the insurgency. In this situation, how the system should prevent the state from being captured by opponent. The simulated model behavior presented in figure 6.12 and 6.13.

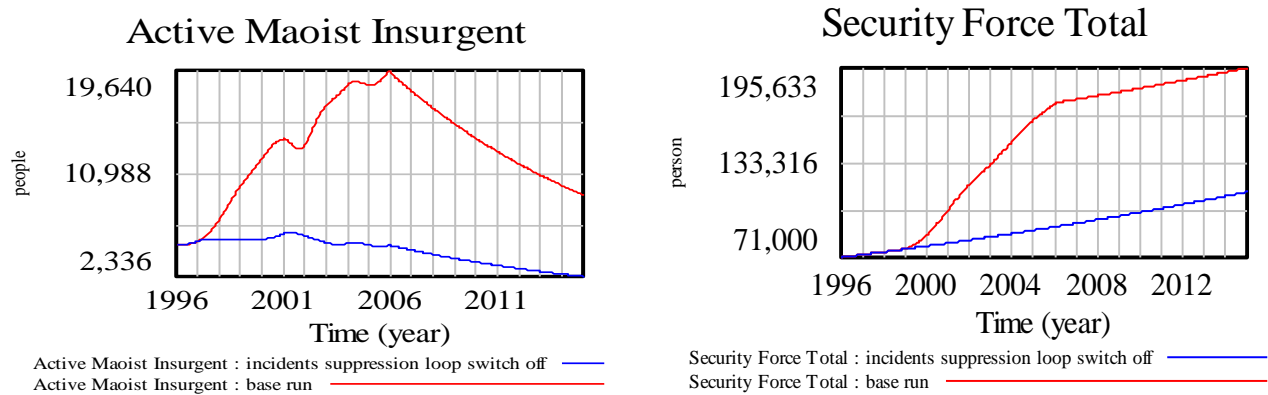


Figure 6.12: Insurgency and Incident Suppression: - Maoist Insurgent and Security Force Total

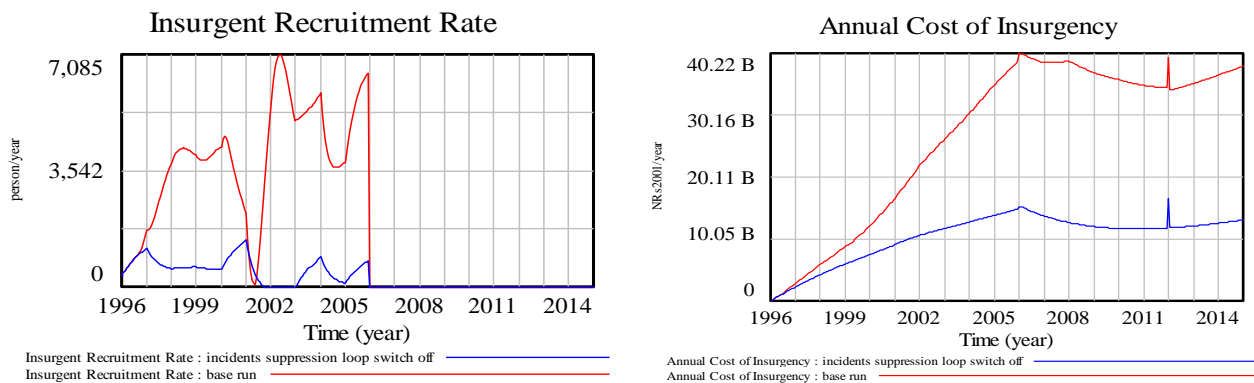


Figure 6.13: Insurgency and Incident Suppression: - Insurgent Recruitment Rate and Annual cost of Insurgency

Scenario five assumes that the security force did not commit offensive suppressive actions with increased insurgent incident committed by the Maoist. If security force lay down the weapons, is there any possibility of being captured by the opponent? It is impractical to model the insurgency dynamics in such a way. The number and strength of the Maoist rely on three flows, as discussed in chapter four, as the recruitment, retirement and attrition of insurgent. The equation for insurgent attrition composed of attrition from suppression plus insurgent incidents*fractional attrition rate. It means that even the suppression actions by security force stopped, the attrition of insurgent does not stop in the system. The more incidents they commit, the higher their number of casualties. The recruitment stopped to zero because people do not perceive coercive action from the security force. However, insurgent incident creates dissatisfaction with the insurgent that affect adversely on their recruitment. In both cases whether they commit more incidents or security force commit less suppressive actions, the intensity of insurgency slow down.

The figure above clearly shows that if suppressive actions reduced to zero, the number of insurgents does not increase from the initial level rather decrease their number. However, the model does not consider the impact of coercive recruitment of people in the Maoist. As discussed in chapter three, coercive supporter may not be considered as insurgent until they give clear support to the insurgent.

From the above discussion, it is clear that the system protect the security forces from being captured even if they stop offensive acts. Defensive strategy favors the security force rather than offensive one. Offensive strategy will only be beneficial if state has sufficient state capacity and can control insurgency in short time period with strong public support.

6.2.7 Scenario Six: Insurgency and Insurgent Creation

Base scenario explains how insurgent creation loop activates when insurgent suppression loop dominates the model. Scenario five discussed how insurgency developed if the suppressive actions by the security force reduce to zero.

This scenario aims to present idea that how long insurgency survive, if the insurgency creation loop is switched off assuming that the Maoist activities rely on an initial number of insurgent and are not able to recruit people as active insurgent after insurgency starts. The figure 6.14 shows the model behavior of active Maoist insurgent and insurgent incidents.

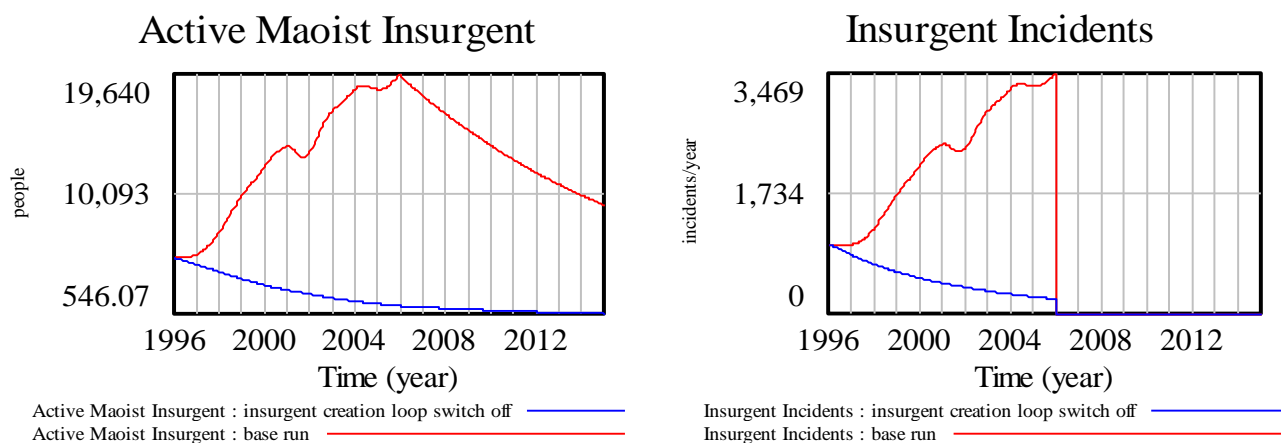


Figure 6.14: Insurgency and Incident Creation: - Active Maoist Insurgent and Insurgent Incidents

The figures 6.13 shows approximately linear decay behavior in both insurgent number and incidents when the insurgent creation loop is switched off. The insurgent number reduced to zero in 2010. However, this is not correct proposition in normal conflict situation. As discussed in section 3.3.4.1, when recruitment is greater than attrition the stock of insurgent increases and vice versa. So it can be concluded that the insurgency primarily rely on the insurgent number for their activities. The state should focus on moderating their recruitment base by applying long-term and short-term strategies. In the long-run, the government should focus on strengthening state capacity by improving in governance, employment, legitimacy and economy. While, in the short-run, sincere effort should pay to improve public satisfaction by compensating adverse effect of their suppressive actions so as to maintain public support.

6.2.8 Scenario Seven: Insurgency and War Weariness

The base scenario describes from where war weariness message comes and how these messages affects insurgency dynamics. When intensity of conflict deepens with the greater number of insurgent incidents, the civil society, the human right activists and the people do worry about the war and create pressure for a peaceful solution of the conflict. War weariness messages come from the populace that influences the policy of usage and growth of security forces. Direct extreme condition test in section 5.3.5 explains how the behavior changes, if different time delay assumed about war weariness.

This section under scenario seven has discussed how model behavior differs with the base case if the war weariness switched off. The model behavior presented in figure 6.15 and 6.16.

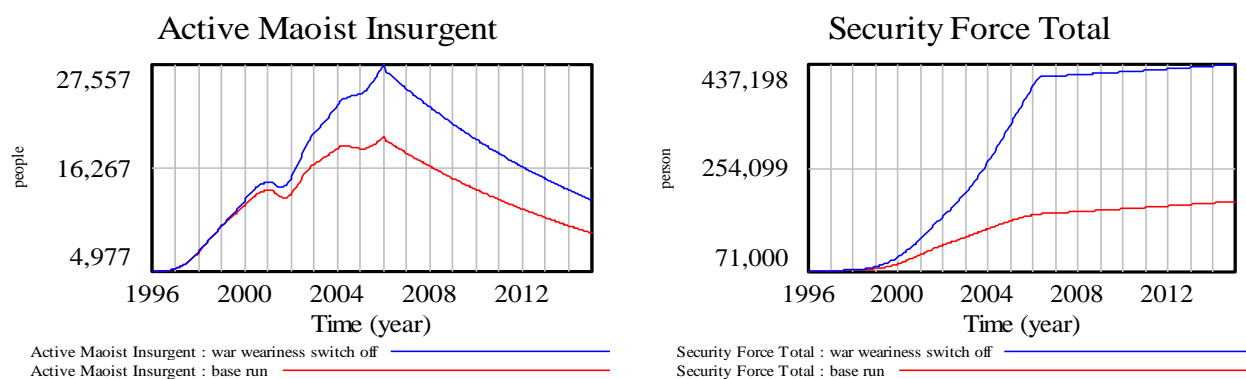


Figure 6.15: Insurgency and War Weariness: - Active Maoist Insurgent and Security Force Total

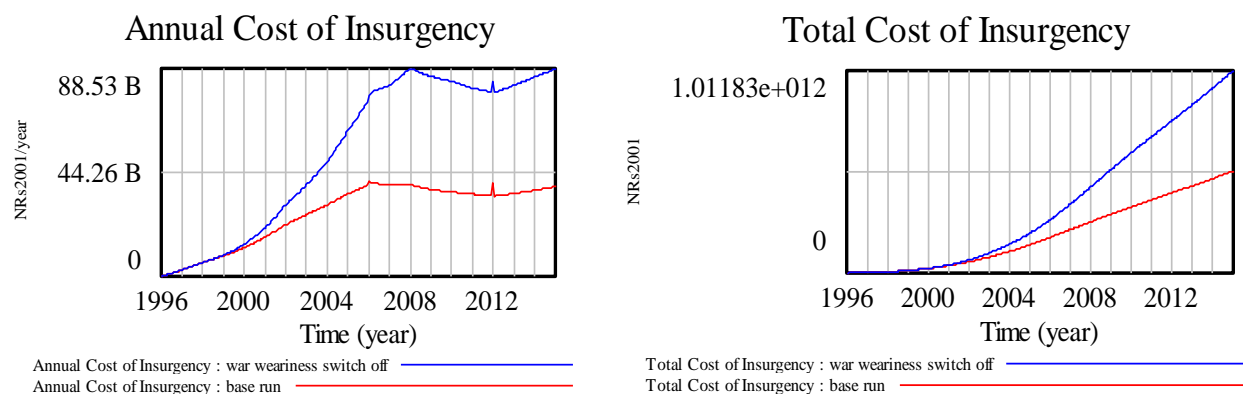


Figure 6.16: Insurgency and War Weariness: - Annual cost of Insurgency and Total Cost of Insurgency

Assumption of this scenario is that war weariness is not the part of the system. The government has not any pressure for dialogue, or the government ignores such pressure. The aim of security force is to control such incidents at any cost and means. In this scenario, the war becomes even higher than in the base case. Coercive actions generate adverse impact on public satisfaction that turned into support to the insurgent. Therefore; they can recruit more insurgent. This scenario develops reinforcing behavior in the system.

War weariness messages are mainly pressure to the government for minimizing offensive activities and for peaceful settlement of the conflict. The government may ignore such messages due to legitimacy, security force strength and other political reasons. However, ignoring such messages may have counterproductive in term of lives and property lost even greater in number and value. However, the government should aware not to give time to insurgent for preparation of war even in great magnitude in the name of war weariness. The ideal way to handle the situation is to conduct activities with efficient intelligence so that the people feel safe and secure during operation.

6.2.9 Scenario Eight: Insurgency and Hidden cost

This scenario aims to present the idea that the cost of conflict not only covers the cost during conflict, but the country must bear after many years. There must be a number of veterans that need continued cost to take care of them. Scholars mentioned that the health care, disability and retirement cost for veterans from past wars came 30 to 40 years after those wars ended (DAO,

2011 cited on Supinajaroen, 2011). So after cost of conflict is unavoidable for the total costs of conflict and it must be calculated. Before the step of other considerations, the after-conflict cost must be implemented. This scenario adds structure of after-conflict cost shown in figure 4.5 and calculates it as part of the costs relevant. The after-conflict cost structure is tested by on its fraction and lifetime. First, the fraction of the cost that determine the rate of after-conflict cost is tested by the values 0.00, 0.10 (base run value), and 0.20 the results are shown in figure 6.17.

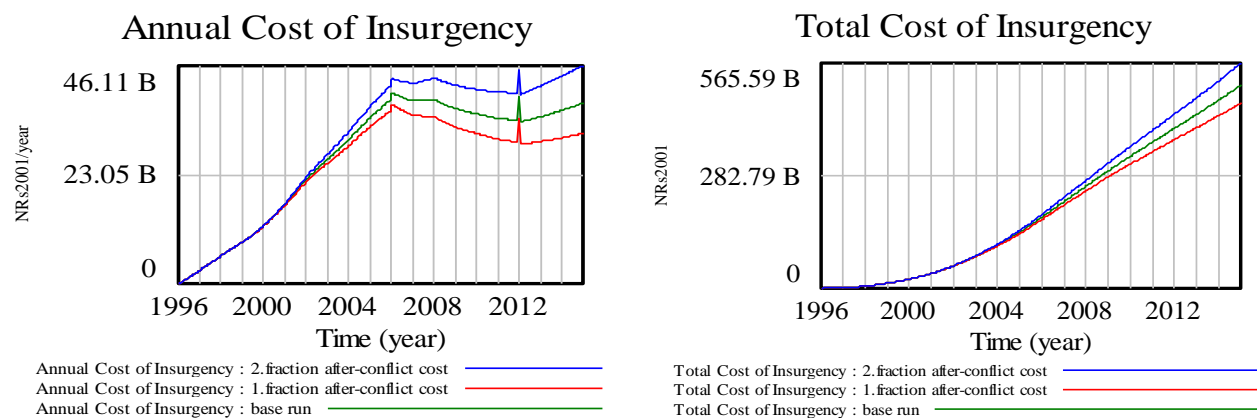


Figure 6.17: Insurgency and Hidden Cost: - Annual cost of Insurgency and Total Cost of Insurgency

The result shows that earliest stage of conflict the difference in cost is not clear, but after 2002 it shows clear picture and the gap increased year after year. Second, the lifetime of cost is tested by the values 10, 30(base run value), 60 years. The result in the figure 6.18 shows that annual after-conflict cost is low when life time is earlier and vice versa.

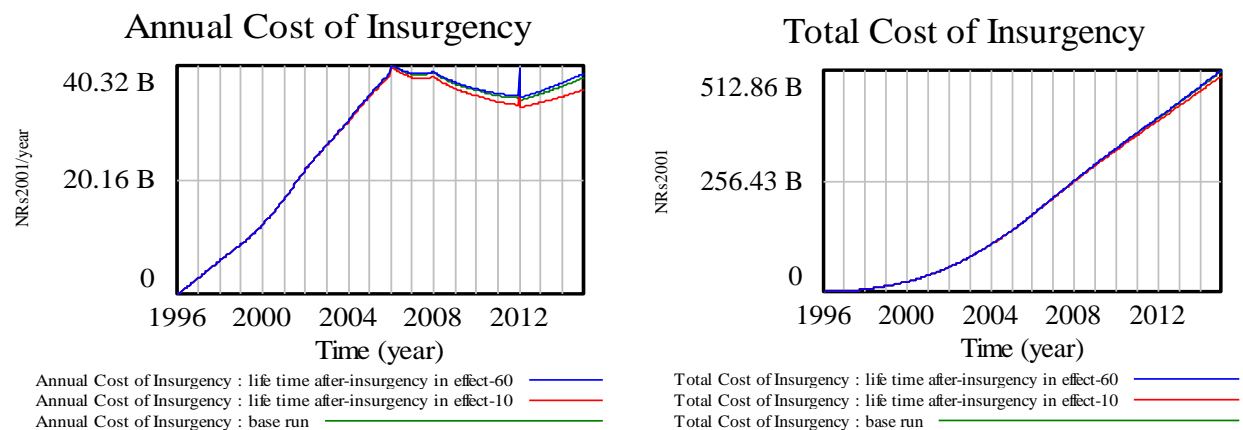


Figure 6.18: Insurgency and Life Time: - Annual Cost of Insurgency and Total Cost of Insurgency

Thus, the scenario shows that it is necessary to include the after-conflict cost to the cost of conflict. Cost component especially hidden cost is under perceived component during insurgency in Nepal. People talk about lives, business and infrastructure. Economic impacts are to some extent analyzed. So, after this scenario, the hidden cost of conflict added as one of the model structure and considered as part of insurgency costs.

6.3 Discussion

The purpose of this study is to examine the dynamics of insurgency evolution, mitigation and associated costs by simulation of conflict scenarios in Nepal. The simulation might help to answer the questions such as how the insurgency evolves? What are the conditions under which intensity of the insurgency depends on? To what extent the conflict affects economic performance of the country? The study results that there are two points of view need to be discussed as the generic model design and its usability and conditions at which intensity of insurgency and cost depends on.

6.4 The Generic Model and its Usability

The model covers a mechanism of insurgency dynamics and associated cost of the insurgency. The people, the Maoist and the government especially security force are the principal actors of insurgency dynamics. Public satisfaction covers how people perceive activities of the Maoist and the state. It is an important variable in the model that determines insurgent recruitment and also attrition from suppression. However, in term of the state capacity elements, the model does not cover all relation of state capacity element as endogenous variable. Only economic element has taken as endogenous. Time series data for other elements used to calculate state capacity. This formulation does not reflect much difference with the hypothesis. Therefore, the simulation for all scenarios indicate hypothesis of insurgency dynamics and costs.

6.5 Conditions at which Intensity of Insurgency and Cost Depend

The base scenario reflects environments of insurgency dynamics in Nepal. It describes how insurgency evolves, its intensity and its cost compared with reference data. The behavior generated by a generic model under base scenario is the product of the number of actor involve;

capacity poses; people's perception about activities; and development of the element of the state capacity. Base scenario based on the assumptions that lack of understanding the entire dynamism of insurgency development and mitigation has contributed to the cost of the conflict. This part attempts to discuss on various possible conditions at which intensity and cost of insurgency rest on.

6.5.1. Adjustment Time and Insurgency Dynamics

This study aims to observe the behavior of the insurgency dynamics and its response over time. Time delay is an important consideration of any system dynamics modeling. Number of time elements assumed in this study. Changes in adjustment time produce different behavior in the system. Some variables are sensitive to the time delay and some are not. Extreme condition test in section 5.3.5 explains the impact of the time element on growth of the insurgency such as time to join the insurgency, an average career of insurgent, time to weary, time to create pressure, time to dissatisfy, and so on. Some of the time elements balance the effect of other time elements. For example, longer time to weary deepens the intensity of conflict, but longer time to dissatisfy balance this effect in the system. Similarly, shorter time to create pressure increases intensity of conflict while shorter war weariness compensates its result.

6.5.2. Parameter and Insurgency Dynamics

Some of the parameters are highly sensitive to the model behavior. Section 5.3.5 describes the sensitivity of parameter. Insurgent parameter, satisfaction parameter, economic effect parameter, maximum suppressive acts are some of the sensitive parameters in the model. The difference of the value of these parameters will lead to much difference in the model behavior. The sensitivity analysis in section 5.3.6 describes parameter sensitivity. However, there are compensating natures of these parameters. For example, high value of the satisfaction parameter will compensate low value of insurgent parameter and vice versa.

6.5.3. Scenarios and Insurgency Dynamics

Section 6.2 describes different possible conflict scenarios and explains how and to what extent the behaviors differ with the base scenario. This section explains in which condition these scenarios play remarkable contribution to deepening or weakens insurgency.

Scenario one assumes that the state capacity ensures resource availability to the security force; compensate adverse effects of insurgency to the economy and stop insurgent recruitment. Section 6.2.2 describes the impact of state capacity by taking different value of it. This scenario clearly shows that a strong state capacity reduces intensity of conflict significantly, because the security force may control insurgency without compromising level of public satisfaction. The cost of conflict will also be low because state capacity compensates an adverse effect of conflict to the economy. However, weak state capacity supports insurgent recruitment and ability to commit incidents. On the other hand, security force could not launch sufficient counterinsurgency operation due to lack of resources. Weak state capacity could not able to compensate bad result of the insurgency, therefore, increase an indirect cost of conflict. Moderate state capacity does not play higher impact on the system; other elements do play an import role in insurgency dynamism.

Scenario two assumes changes in the population size affect the insurgency dynamics. However, compared to other scenarios, the intensity of conflict taking population stock constant or dynamic do not generate much difference in the system behavior.

Scenario three assumes actors' activities do not affect the level of public satisfaction. Section 6.2.4 describes that if insurgent activities assume to be free with public satisfaction, the intensity of conflict increases; if security force activities do not create bad effect on public satisfaction, the intensity of conflict decreases. It is because dissatisfaction with the government is the engine of growth of the insurgency in this model. It is why the actors should try not to dissatisfy people while launching their strategies of the defeating enemy. As discussed in Chapter Three, they should be serious that direct or indirect actions against the opponent should not have an adverse impact on the people if they are pursuing long term strategy to achieve their goal. What is seen in Nepal that, especially, the Maoist, pursue a strategy of exciting and compelling security force to commit coercive actions so as to gain public sympathy.

Scenario four describes if insurgent and security force has sufficient resource capacity to involve in the conflict, the intensity of conflict increase to some degree. However, insufficient resource capacity and excess resource capacity of both parties reduce intensity of conflict. Section 6.2.5 explains three time greater resource capacity of both actors increase insurgent

number at initial state but later it began to decrease sharply. This scenario explains that the inadequate resource reduces conflict intensity remarkably, but excess resource does not contribute to increasing the level of conflict. The scenario explains why both parties pursue strategy of destroying opponent resource as discussed in section 3.3.2 rather than to improve their resource capacity.

Scenario five assumes the incident suppression loop switch off and none of offensive action by the security force. In this situation, the result shows that the intensity of conflict slows down. It is because, less coercive action by security force do not hamper public support on the one hand and do not favor insurgent recruitment on the other. However, the question arises that is there any possibility of being captured by the Maoist? It is not possible because defensive strategy keeps public support intact with the government that stops insurgent recruitment. They rely on a limited number. In such situation, their number constantly reduces due to regular retirement and attrition when they commit offensive actions. The hypothesis that less use of power may have a chance of being captured is wrong. House searching, tedious checking in the highway and other offensive actions by security force becomes unpopular in Nepal that dissatisfies people turned into support to the Maoist. So it can argue that less coercive actions could be beneficial in the long run.

Scenario six describes the intensity of conflict is low if the insurgent creation loop is switched off. Section 6.2.7 shows the insurgent number and cost of conflict reduced significantly if this formulation assumed to be true. According to this scenario, the security force should pursue a strategy of moderating insurgent recruitment. Security force should be aware of not to interfere civil life to prevent recruitment while committing suppressive actions. That requires their strong intelligence mechanism so that they can attack on a legitimate target, which is quite weak as discussed in chapter three.

Scenario seven describes how war weariness affects insurgency dynamics and cost of conflict. Assumptions for this scenario are no war weariness and shorter and longer time delay to perceive war weariness. Section 6.2.8 describes that longer the time taken to recognize war weariness, the higher the intensity of conflict. The idea of war weariness is an important component of insurgency dynamics in the model. As discussed in chapter three, war weariness creates pressure

for dialogue and pulls back security force for a peaceful resolution. If there is no war weariness, the government use excessive force that dissatisfy people and strengthen insurgent recruitment, therefore, deepen the conflict even more. What everyone sees, as discussed above, in Nepal that the intensity of the violent incident grow sharply at initial stage, because war weariness has longer time delay to perceive.

Scenario eight describes how after the insurgency cost contributes to increasing total cost of the insurgency in the long run. Insurgency has short-term as well as long-term impact in term of cost associated with it. It is the cost that directs variation to the intensive of conflict, and it comes with the lifetime approximated from the life of soldiers who came back and still alive. Section 6.2.9 describes its impact can be seen many years even after the end of the insurgency.

6.6 Summary

All the insurgency scenarios seem to be costly in term of life, liberty, peace and economy. Whatever the scale of the insurgency, the country must bear such costs. The benefits may be if managed wisely; awareness, issues come into surface that are suppressed before and most importantly realization of truth. The Maoist came to mainstream politics and share power in government after peaceful resolution in 2006. However, the causes of conflict argued as discrimination, poverty, underdevelopment, unemployment and so on remain the same. The country still facing the problem of conflict and continue struggling to settle it with a peaceful manner. The election of second constitutional assembly held in late 2013 bring some hope of improvement in Nepal. From all scenario simulated, the intensity and cost of conflict could be minimized only if both parties in the conflict be responsible for the people; minimize aggression and coercive actions. Use of less military solution could be the best way for Nepal. What have seen in the simulation that the party who committed in minimum coercive activities benefited much and the cost to the economy also tolerable.

Chapter Seven: Conclusion

7.1 Conclusion about General Model and its Implication

Insurgency in Nepal ended with a comprehensive peace agreement in 2006. Thereafter, efforts were paid to establish permanent peace and security in the country. The pace for post-conflict reconstruction and resolution activities seems to be slow. Some of the issues in constitution making are still in debate. Political parties yet to reach in the agreement for forming a commission on truth and reconciliation. The second constitutional assembly elected in 2013 supposed to make a new constitution within a year. With reference to Galtung's approach to peace, Nepal furnished some of the peacekeeping and peacemaking activities, but still lacking in peace-building that constitute peaceful social change through socioeconomic reconstruction and development.

The utility of the model designed in this study is not limited to insurgency in Nepal, rather the implication of understanding and analyzing the war on terrorism as a global insurgency. It indicates a shift in the primary emphasis for the conduct of the insurgency or counterinsurgency activities. The primary emphasis must shift to, and remain on the population. Instead of applying the majority of the resources to answering the insurgency with the military response, the insurgency analysis suggests that focusing on the insurgent's support base and resources is a more efficient method of defeating them. The focus should be given to gain popular support and strengthen the security force intelligence ability to combat the insurgent while at the same time drain the insurgent's ability to commit violent incident.

For any conflict in the world, there have been many misunderstandings of insurgency in the world history. Such misunderstandings are insurgency itself and its consequences. The obvious and up to date case is a war on terrorism. First, a big mistake in estimation of military strategy and operation, by many reasons, the security forces underestimated of its opponents' capability who led to the insurgency exist longer than their estimation. Second, they (policymakers) also ignored and used misperception of insurgency cost and insurgency dynamics as well (Supinajaroen, 2011).

This study finds that armed solution might not be a good answer for any conflict. The cost of armed conflict might always greater than its benefit. The core insight gained from this study is the self-examination of costs and dynamics of the insurgency that design the future of peace and security. The scenarios from this study have drawn this conclusion by the cost and dynamics of the Maoist insurgency in Nepal. On the basis of scenarios discussed in the previous chapter, the following recommendation placed for due attention to the policymaker to prevent burning possible future conflict and to handle properly if violent conflict started.

- ❖ The insurgency should not be thought in the term of military itself, but it should be scrutinized in the top view of the national strategy and the implementation of state capacity elements. Otherwise, the win in the battlefield by military capability might lead to heavy loss to the country. Dynamic of the counterinsurgency operation is that all elements of state capacity must play a role. Military, diplomatic, socio-economic, governance and legislative efforts all must be synchronized and united toward achieving the common principal objective- the defeat of the insurgent and its underlying causes (see also section 6.2.2).
- ❖ The main effort for the state must be to gain popular support. Canonica (2004) argued that first, popular support gives legitimacy to the conduct of operations, and the legitimacy required to operate freely and effectively to counter the insurgent. Second, support of the public provides the necessary intelligence to locate the insurgent members. They can no longer hide within the people. They lose the ability to move and operate freely their activities and the security force could commit counterinsurgency operation with legitimate target. Third, insurgents do also rely on public support, without the people's support to them, the resources needed for their survival and actions are no longer available. Fourth, gaining popular support removes the recruitment base from the potential insurgent. It is a slow process, especially in regions where current support for the state is nominal. Scenario three discussed in section 6.2.4 explains how dissatisfaction with one actor turned into support for other. If the state able to maintain public satisfaction level higher, the recruitment of the Maoist was minimum and for security force it is easy to control their possible activities.
- ❖ The security force must limit the use of direct actions against the insurgent without having efficient intelligence so as to minimize innocent casualties. Scenario five discussed in section 6.2.6 and scenario six in section 6.2.7 explains that the higher the suppressive actions leads to

the lower level of public satisfaction that facilitate insurgent recruitment and higher insurgent activities. It is because, effective use of direct action requires a high degree of intelligence on the target to reduce collateral damage that is a weak part of the security force in Nepal. Excessive force and/or collateral damage results in weak support from the population and the international community. According to Canonico (2004), that the use of excessive force only hinders the counterinsurgency effort. All effort to use direct action must be done with consideration for their effects on the main and secondary efforts.

- ❖ As discussed in chapter three, a short and mid-range strategies should design to disrupt and control the insurgency. The long range strategy focuses on the ideological support to the insurgent and culture of violence. Culture of violence is the tendency to justify violence as a necessity. As long as the people continue to provide support to the insurgent there will continue to be a threat to the government. There are a number of ways to implement the strategies outlined by Dr. McCormick's model discussed in chapter three. The key is to emphasize gaining and maintaining popular support for the campaign. Similarly, according to Upreti (2008) long-term security policy of the nation has to consider the potential security situations in the region and international level. The government should focus on restructuring of security forces (army, police, and intelligence) and ministries (home and defense) enable them to answer conflict. National Security Council should be guided by national security doctrine, international relations and economic policies with strong provision of civilian control and proper oversight from the parliament.
- ❖ Continuous sincere effort must move toward socio-economic-political reform in post-conflict situation to prevent the country being trapped into further conflict. Although, according to Marks (2003) coercion provides the operational driving force behind insurgent expansion; it is the strategic environment of the failed state. Democracy has been corrupt and ineffective; the political class distracted and self-absorbed after 1990. Consequences in the economic and social spheres have accordingly been worsened. Leadership must set in place solutions that can provide the motivation for mobilization.
- ❖ Scenario one in section 6.2.2 explains that the state capacity composed of economic, social, governance and polity index is an important variable of shaping the dynamics of insurgency and cost of conflict. Weak state might always fertile land for crimes and insecurity and is vulnerable of being trapped into conflict. Upreti (2008) argues that in Nepal 'organized

crimes and insecurity continue and expand with activities like extortion, abduction, robbery, looting, narcotics smuggling, rape, girls trafficking, hunting and smuggling of rare animals. It will further expand if the state is not able to deal with transitional security. Hence, addressing transitional security requires improving the elements of national power including democracy and governance.

- ❖ Insurgency, organized crimes and insecurity, as discussed in chapter two, should not be limited to the burden of the country concerned, rather recognize the problem of the international community as a whole. The state should give emphasis in gaining support of the international community for moral and resource support. Scenario four in section 6.2.5 shows weak resource base of the state further deepens the conflict in the country. Exchange of intelligence information, cooperation and collaboration between the states and society are other areas of consideration for improving peace and security.
- ❖ Hidden cost of the conflict is highly under perceived element of cost of the insurgency. Scenario eight in section 6.2.9 shows that the hidden cost continues to grow even after the end of the insurgency. It has long term impact in the economy, therefore, should be given proper insight into its effect and search for a better way of compensating its adverse effect.

7.2 Future Research

Finally, there are some points that are excluded and should be a challenge to study more.

- ❖ The aggregate effect of insurgency on economy has been assumed in this study. However, each insurgency has different conditions. Thus for Nepal, need to design more about the different area of the economy to examine how the insurgency increases or decreases the demand of the product of the sector and how the sector output supports or opposes to economic development. For example, tourism is to be considered the most affected economic area in Nepal. There is some argument, as discussed in chapter two, that military spending leads to positive economic growth by increasing aggregate demand which results in increased output and employment. However, this increase seems to be 'heat from burning house.' Military spending crowds out productive investment; leads to lower rate of growth and unemployment as well as increases lost output. Thus, the study requires further extension of economic aspects. A larger set of infrastructures could be included, such as communications,

the media, transportation, tourism education, agriculture, and manufacturing. This approach may facilitate to identify the most sensitive area of the economy in which the government could focus seriously so that bad result of the insurgency could be minimized in the future.

- ❖ Strong state capacity considered as discussed in chapter six, to be an important element that compensate adverse effects of insurgency. A weak state becomes the fertile land for insurgency. In this study, the determinants of state capacity are taken several indexes on the basis of the literature review as polity, GDP, civil liberties, employment, literacy and governance. These factors except economic are considered as exogenous input to the system. However, to measure dynamic effect of these factors on the system, the model should be further extended making them endogenous variable in the system. It will help to point out measurable area of state capacity so that serious attention could be paid for improvement in the future.
- ❖ The model developed in this study allows an analyst to take a very complex problem and gain insight into it by dividing it into manageable parts. It enables the analyst to aggregate assumptions about simpler questions such as the effectiveness of security force, the growth rate of the economy, direct and indirect cost of conflict. However, effects of propaganda, intelligence and government corruption are not considered separately while modeling due to unavailability of reliable data. The model need to further extended considering these elements and their effect in insurgency dynamics.
- ❖ Security forces have been taken as a single entity for the purpose of this research. However, for effective analysis it is imperative to model them separately with recruitment, training, retirement, attrition. Data is needed on the effectiveness of the army, police officers, intelligence and other types of security forces. Security situation also depends on criminals and crime rate. There is a possibility to expand the model so as to incorporate criminals and crime for better understanding the security situation in the country.
- ❖ The attitude of the populace should be simulated dynamically and could be used to simulate the outcome of the election.

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Annex I: Security Forces in Nepal

Current manpower of security forces, 2013						
Category	1990	1996	2001	2007	2012	Remarks
Nepal Army	35000	46000	47411	92000	95000	
Armed Police Force			15156	25000	35000	
Civil Police	20000	46500	37783	48000	61171	
	55000	91500	99250	165000	191171	
Metropolitan Police			Established 2006	12000	13752	
	Source: Kumar (2007), Marks (2003), Dahal (2008), www.nepalpolice.gov.np ; www.nepalarmy.mil.np ; www.apf.gov.np , World Bank Database					

Annex II: Timeline of Political Development in Nepal

The history of modern Nepal begins with the unification by the King Prithvi Narayan Shah (1743- 1775). Before its emergence as a nation 'Nepal' was mostly applied only to the Kathmandu Valley and its history is mostly the history of the Kathmandu Valley (Shina, 1974). Power struggle among Bhardar and fraction inside the royal family had led to a period of instability after the death of King Prithivi Narayan Shah. The instability deepened after Sugauli Treaty that led the Kot Massacre in 1846 where almost all leading Bhardar killed and Jung Bahadur Rana emerged victoriously and founded the Rana Lineage. Kot is the place where the member of Bhardhari Sava (assembly of Bhardar) meets for discussion on the matter of government (Edwards, 1974).

There are four major political event noticed from 1770 to 1951(when Nepal achieved democracy) which shift power from one family or elite group to another. In 1806, Thapa family gained a virtual monopoly in the political system; in 1846 Rana family reached a similar state; in 1885 power shifted to Shamsheer branch of Rana family; in 1934, a group of Shamsheer Rana came into power. All political changes occurred through more or less massacre (Bajracharya et. Al. 1993:2).

In 1951, Nepal achieved democracy and restored the status of the monarchy after the overthrow of the Rana oligarchy. In 1960 when king Mahendra suddenly dismissed the cabinet and dissolved the parliament. The king also banned political parties and imposed restrictions on the most fundamental human rights. In 1980, King Birendra declared a referendum on the future of Party less Panchayat system. In 1990, Panchyat System was replaced by multi-party

parliamentary democracy with a constitutional monarchy by popular movement called Jana Andolan I.

In 1996, the Maoist raises armed by refusing fundamental premises of the constitution 1990 aiming to overthrow kingship from the country and established democratic republic. In 2002, when the King take over all political power claiming to restore peace and security in the country, all political parties and the Maoist came to a twelve point agreement and launched a popular movement against the King. A popular movement in 2006 called second Jana Andolan against monarchy overthrow monarchy and established federal democratic system in Nepal (Khadka, 1993; Brown, 1999; and Hachhethu and Gellner, 2009). In 2008, the constitutional assembly election held which elected the member of the assembly. The assembly was not able to deliver new constitution, finally in 2012, the assembly dissolved. In 2013, second constitutional assembly formulated through fresh election and supposed to deliver new constitution within a year.

Annex III: Model Equations

Sector 1: Insurgent and Security Force Activity

Stocks

Active Maoist Insurgent= INTEG (Insurgent Recruitment Rate-Insurgent Retirement Rate-Insurgent Attrition Rate, initial active insurgents): Unit =people

Security Force Normal= INTEG (SF Normal Growth Rate, 71000), Unit = person

Security Force Additional= INTEG (Additional SF Growth Rate, 0), Unit = person

Maoist Weapon and Resource= INTEG (Weapon and Resource Growth Rate-Weapon and Resource Loss Rate, initial Maoist Resources), Unit = NRs

Flows

Insurgent Recruitment Rate=IF THEN ELSE (Time<end of insurgency time, MAX ((Indicated Insurgents-Active Maoist Insurgent)/time to join insurgency, 0)*insurgent creation switch, 0) Unit = person/year

Insurgent Attrition Rate= Insurgent Incidents*fractional attrition rate + Attrition rate from suppression,
Unit = people/year

Insurgent Retirement Rate= Active Maoist Insurgent/avg insurgents career in years, Unit =person/year

SF Normal Growth Rate= Security Force Normal*SF normal growth fraction, Unit = person/year

Additional SF Growth Rate=IF THEN ELSE (Desired Security Force>Security Force Total, (Desired Security Force-Security Force Total)/Time to adjust desired SF, 0) Unit = person/year

Weapon and Resource Growth Rate= IF THEN ELSE (Desired Insurgent Weapon and Resources>Maoist Weapon and Resource, (Desired Insurgent Weapon and Resources - Maoist Weapon and Resource)/time to fulfill desired resource, 0), Unit = NRs/year

Weapon and Resource Loss Rate= IF THEN ELSE (Time<=end of insurgency time, (Maoist Weapon and Resource/weapon and resource depletion time) + (Maoist Weapon and Resource*Ef of suppressive action on Insurgent Resources), 0) Unit = NRs/year

(This measures the loss rate of weapon and resources. the stock of resources deplete at normal rate and plus loss from suppressive actions by the SF during insurgency).

Variables

Relative Weapon and Resources= (Maoist Weapon and Resource/Active Maoist Insurgent)/(initial Maoist Resources/initial active insurgents), Unit = Dmnl

(This measures the relative per capita insurgent resources)

Eff of Insurgent Resource on Incidents= 1-exp (-Relative Weapon and Resources*insurgent resource parameter), Unit = Dmnl

Insurgent Incidents= IF THEN ELSE (Time<=end of insurgency time, MAX (Active Maoist Insurgent*incidents per insurgent*Eff of Insurgent Resource on Incidents, 0), 0), Unit = incidents/year

(How many raids, snipping, bombings etc. are committed in total by all insurgents)

Desired Insurgent Weapon and Resources = IF THEN ELSE (Time<=end of insurgency time, Active Maoist Insurgent*Required resource per person, 0), Unit = NRs

War Weariness= SMOOTHI (Insurgent Incidents/ref incidents*war weariness switch, time to weary of insurgency, 0), Unit = Dmnl

Pressure to Reduce Incidents= SMOOTHI (Insurgent Incidents/ref incidents, Time to create pressure, 0), Unit = Dmnl

(This is the effect of incidents on the urgency felt by government to do something about it. The effect of this will be lagged in its outcomes).

Eff of War Weariness on Desired SF= WITH LOOKUP (War Weariness,([(0,0)-300,1)],(0,1),(10.0917,0.890351),(24.7706,0.776316),(44.0367,0.635965),(72.4771,0.482456),(101.835,0.355263),(140.367,0.219298),(186.239,0.114035),(237.615,0.0482456),(300,0))) Units: Dmnl

(The wearier the public is with the war, the less security forces they maintain in the operation.)

Eff of Pressure on Desired SF= WITH LOOKUP (Pressure to Reduce Incidents, ([(0,0)-300,500)],(0,0),(37,18),(72.4771,50.4386),(113.761,92.1053),(157.798,140.351),(197.248,203.947),(223.853,263.158),(255.046,353.07),(277.064,418.86),(300,500)))Units: Dmnl

Desired Security Force= base SF Mobilized*Eff of Pressure on Desired SF*Eff of War Weariness on Desired SF, Unit = person

Security Force Total=Security Force Additional + Security Force Normal, Unit = person

Maximum SF Deployed= Security Force Total*fraction maximum SF deployed, Unit = people

(Note that this variable includes the number of security forces used in the counter insurgency operation and is not representing the total security forces the country has.)

SF Mobilized= IF THEN ELSE (Desired Security Force<Maximum SF Deployed, Desired Security Force, Maximum SF Deployed) Unit = person

Suppressive Act per Soldier= $\text{SMOOTH}(1 - \exp(-\text{Suppressive parameter} * \text{Pressure to Reduce Incidents}), \text{Suppression response time}, 0) * \text{max Suppressive acts}$, Unit = actions/person/year

(Acts of house searching, detainment etc. may lead to arrest of an insurgent. It is an increasing function of the pressure to reduce incidents with diminishing returns.)

SF Suppressive Actions= IF THEN ELSE (Time<=end of insurgency time, SF Mobilized*Suppressive Act per Soldier*Eff of State capacity on SF resources*incident suppression loop switch, 0), Unit = actions/year

(Total counter operation by all security forces and paramilitaries in the country including house searches, detained etc.)

Relative Suppressive Actions= SF Suppressive Actions/ref suppressive actions, Unit = Dmnl

Eff of suppressive action on Insurgent Resources= $\text{SMOOTH}(1 - \exp(-\text{suppression fruitful parameter} * \text{Relative Suppressive Actions}), \text{time to create eff on resources}, 0) * \text{maximum effect on insurgent resources}$, Unit =Dmnl

(This is an increasing function with a max at one.)

Attrition rate from suppression= SF Suppressive Actions*Relative Active Maoist Insurgent*Suppressive Acts Success, Unit = person/year

(The fractional attrition rate from operation)

Suppressive Acts Success= base suppression success*Ef on Attrition Rate, Unit = person/action

(This modifies how many insurgents will be captured per coercive act in the base case)

Relative Active Maoist Insurgent= (Active Maoist Insurgent)/initial active insurgents, Unit = Dmnl

(What is the effect of insurgent density on finding an insurgent?)

Internal Source of Maoist Resources= Weapon and Resource Growth Rate*share of internal source, Unit = NRs/year

Relative Insurgent/SF activity = (SF Suppressive Actions + Insurgent Incidents)/reference activity Unit = Dmnl/year

Eff of State Capacity on Insurgent Recruitment= $\text{XIDZ}(1, \text{State Capacity}^{\text{elasticity of State Capacity to recruitment}}, 1)$ Unit = Dmnl

Potential Insurgent Recruitment Fraction= (minimum insurgent fraction activated+ (Eff of Satisfaction on Insurgent Number/Eff on Insurgent Recruitment))*Eff of State Capacity on Insurgent Recruitment, Unit = Dmnl

(It is the fraction of potential insurgents actually wants to take up arms)

Potential Insurgents=(fraction of people liable to join insurgency*Total population)-Active Maoist Insurgent. Unit = people

Indicated Insurgents= IF THEN ELSE (Potential Insurgents> (base insurgent fraction*Potential Insurgent Recruitment Fraction*Potential Insurgents), base insurgent fraction*Potential Insurgent Recruitment Fraction*Potential Insurgents, Potential Insurgents), Unit = person

(This is how many insurgents there could be if they could immediately “join up” and pick up arms.)

Total population = IF THEN ELSE (Switch Population=1, population time series, Population 1996), Unit = person

Population time series=WITH LOOKUP (Time, ([(1996, 0)-(2015, 4e+007)], (1996, 2.06905e+007), (2001, 2.31514e+007), (2011, 2.66208e+007), (2015, 2.85899e+007))), Unit = Dmnl/year

Base insurgent fraction= INITIAL (initial active insurgents/Potential Insurgents), Unit = Dmnl

(This is the base fraction of the population that will be attracted to insurgent activities)

Constant

Insurgent creation switch= 1 Unit = Dmnl

War weariness switch= 1, Unit = Dmnl

(1= War Weariness Loop On, 0 = War Weariness Loop Off)

Incident suppression loop switch= 1, Unit = Dmnl

(1 = Incident Suppression Loop on, 0 = Incident Suppression Loop off)

Switch Population= 1, Unit = Dmnl

(1= taking population time series, 0= considering population constant of 1996)

Insurgency start switch= 1, Unit = Dmnl

(1= insurgent open fire, 0= no insurgent incidents)

Time to join insurgency= 0.5, Unit = Month

Time to weary of insurgency= 3, Unit = year

Time to create pressure= 1, Unit = year

(Scaling factor for impact of incidents on pressure on the Govt)

Time to adjust desired SF= 3, Unit = year

avg insurgents career in years= 12, Unit = years

(The number of years an insurgent will be active assuming that he is not captured)

Time to fulfill desired resource= 1, Unit = year

Suppression response time= 1, Unit = year

End of insurgency time= 2006, Unit = year

(Comprehensive Peace Agreement signed in Nov. 2006 end the violent conflict and initiated the process of registration of Maoist Combatants in cantonment. Thereafter there is no direct confrontation between SF and Maoist Insurgents.)

Time to create eff on resources= 0.5, Unit = year

Insurgent resource parameter= 5, Unit = Dmnl

(Availability of weapons rapidly escalates the effect of any incident)

Max Suppressive acts= 0.2, Unit = actions/person/year

(This is a limit on how many counter operation a soldier could commit per month)

Minimum insurgent fraction activated= 0.1, Unit = Dmnl

(There are always some discontents in most societies)

Fractional attrition rate= 0.1, Unit = persons/incident

(How many insurgents are captured or killed per incident?)

Initial active insurgents= INITIAL (5000), Unit = people

Insurgent parameter= 2, Unit = Dmnl

(This is the power that modifies the effect of public satisfaction with the government on Insurgent numbers. This power should be greater than 1)

Reference activity= 100, Unit = activity

Share of internal source= 0.85, Unit = Dmnl

Ref incidents= 36, Unit = incidents/year

Fraction maximum SF deployed= 0.6, Unit = Dmnl

(Only about 60% of the force is available to commit to the counterinsurgency as the remaining troops are deployed to static security duties such as protecting government offices, barracks and infrastructures),

Attrition parameter= 0.5, Unit = Dmnl

Base suppression success= 0.05, Unit = person/action

(This modifies how many insurgents will be captured or killed per counter operation in the base case)

Population 1996= 2.06905e+007, Unit = people

(Base population based on the year 1996 when insurgency broke out in the country)

Suppressive parameter= 0.4, Unit = Dmnl

(This causes the counter operation per soldier to have diminishing returns to the "pressure to reduce incidents". It should be set to be less than one.)

Fraction of people liable to join insurgency= INITIAL (0.1275), Unit = Dmnl

(Employment to population ratio in 1996 was 83%, hence 17% unemployed people may have potential stock of the population that Maoist could recruit. There are almost 50% male and 50% female. In Maoist insurgent the ratio of male and female is about 4:1, so 25% of the female are also being potential insurgent.)

Incidents per insurgent= 0.2, Unit = incidents/person/year

SF normal growth fraction= INITIAL (0.025), Unit = Dmnl/year

(Annual growth of SF in normal situation is based on data from 1983 to 1991. the growth is calculated as $(P_{t1}/P_{t0})^{1/n} - 1$. where P=SF personnel t_1 =present time, t_0 =initial time and n=number of period)

Base SF Mobilized= 6000, Unit = person

Initial Maoist Resources= Required resource per person*5000, Unit = NRs

Weapon and resource depletion time= 2, Unit = year

(Most of the part of Maoist resources used in food, shelter, clothing and other accessories. the resources collected each year also used accordingly. the weapons and some accessories have longer life time. so in an average, it is assumed, the collected resources will depreciate at 2 year time period.)

Required resource per person= 36000, Unit = NRs/person

(This is the insurgent weapon and resource per person including insurgent army accessories, food, clothing, shelter and weapons. Insurgents are voluntary fighter against the state; hence need to assume monthly payment as salary or allowance. Even though most of the cost they collect free of cost from villagers using coercion such as food, shelter. However, this is the shift of burden to the people should count in the cost of insurgency in a low case scenario this expenditure assumed 3000 NRs per person per month and 5000 NRs per person per month in high case)

Suppression fruitful parameter= 0.5, Unit = Dmnl

SF resource parameter= 5, Unit = Dmnl

Maximum effect on insurgent resources= 0.75, Unit = Dmnl

Ref suppressive actions= 25, Unit = actions/year

Sector 2: Public Satisfaction

Stocks

Public Satisfaction with the Government= INTEG (Chg in Satisfaction with the Gov, 1), Unit = Dmnl

(This is an index of how satisfied the public are with government. Note that there is a first-order delay between the indicated satisfaction as a function of current SF suppressive acts and the change in perceptions by the people.)

Public Satisfaction with the Maoist Insurgent= INTEG (Chg in Satisfaction with Insurgent, 1), Unit = Dmnl

(This is an index of how satisfied the public are with insurgent. Note that there is a first-order delay between the indicated satisfaction as a function of current Insurgent incidents and the change in perceptions by the people.)

Flows

Chg in Satisfaction with the Gov= (Indicated Public Satisfaction with the Gov-Public Satisfaction with the Government) /IF THEN ELSE (Indicated Public Satisfaction with the Gov>Public Satisfaction with the Government, time to satisfy, time to dissatisfy)*switch satisfaction with gov, Unit Dmnl/year

(This measures how quickly public satisfaction with government changes. Note that the time for satisfaction to decrease and to increase is different)

Chg in Satisfaction with Insurgent= (Indicated satisfaction with the Maoist-public Satisfaction with the Maoist Insurgent)/IF THEN ELSE (Indicated satisfaction with the Maoist>public Satisfaction with the Maoist Insurgent, time to satisfy, time to dissatisfy)*switch satisfaction with insurgent, Unit = Dmnl/year

Variables

Eff of internal source on population= Internal Source of Maoist Resources/Total population, Unit = Dmnl

Eff of Insurgent Incidents on Civil Life= Insurgent Incidents/Total population, Unit = 1

Indicated satisfaction with the Maoist= MIN (XIDZ (1, (Eff of Insurgent Incidents on Civil Life/ref effect of insurgent incidents + effect of internal source on population/ref effect of resource collection)^satisfaction parameter, 1), 1)

Unit = Dmnl

Eff of Suppressive Actions on Civil Life= (SF Suppressive Actions/Total population), Unit = actions/person/year

(How much is the average citizen aware of counter operation by the Government?)

Indicated Public Satisfaction with the Gov= MIN (XIDZ (1, (Eff of Suppressive Actions on Civil Life/ref eff of suppressive actions) ^satisfaction parameter, 1), 1), Unit = Dmnl

(This is how satisfied the people would be with government absent any legacy effects. It's primarily determined by the government interference in civil life through coercive acts.)

Ef on Attrition Rate= IF THEN ELSE (insurgency start switch=1, Public Satisfaction with the Government ^attrition parameter, 1), Unit = Dmnl

(This is a multiplier that affects coercive fruitfulness depending on public satisfaction with the government. If the public are highly dissatisfied, they will make it difficult for the SF suppressive acts to result in capturing an insurgent).

Eff on Insurgent Recruitment= XIDZ (1, public Satisfaction with the Maoist Insurgent, 1) ^insurgent parameter, Unit = Dmnl

Eff of Satisfaction on Insurgent Number= XIDZ (1, Public Satisfaction with the Government, 1) ^insurgent parameter, Unit = Dmnl

Constant

Switch satisfaction with insurgent= 1, Unit = Dmnl

(1= open satisfaction/dissatisfaction with insurgent, 0= ignore satisfaction with insurgent)

Switch satisfaction with gov= 1, Unit = Dmnl

(1= consider public satisfaction with the government, 0= ignore public satisfaction with the government)

Time to dissatisfy= 0.5, Unit = year

(Time needed to upset the public)

Time to satisfy= 3, Unit = year

(Time needed to satisfied the public)

Ref effect of suppressive actions= 0.0001, Unit = actions/person/year

(Scaling factor for public Satisfaction)

Ref effect of resource collection= 100, Unit = NRs/person/year

Ref effect of insurgent incidents= 0.0001, Unit = incidents/person/year

Satisfaction parameter= 0.44, Unit = Dmnl

(This should be set to less than one to ensure diminishing returns to coercive acts)

Sector 3: Impact of Insurgency on Economy (Non-military effect)

Stock

GDP at Normal Situation= INTEG (Normal GDP Growth Rate, 3.51087e+011), Unit = NRs2001

GDP at Insurgency= INTEG (GDP at Insurgency growth rate, 3.51087e+011), Unit = NRs2001

(Nominal GDP is taken as base of 1990)

Economic Effect of Insurgency= INTEG (Economic Effect Increase Rate, 0), Unit = Dmnl

Flows

Economic Effect Increase Rate= Gap of Economic Effect/Time to adjust gap of economic effect, Unit = Dmnl/year

(This is the desire of the government to pull out of security forces from the operation and try to settle disputes in peaceful manner due to weariness with the insurgency.)

GDP at Insurgency growth rate= GDP at Insurgency*Effective GDP Fraction, Unit = NRs2001/year

Normal GDP Growth Rate= GDP at Normal Situation*gdp normal growth fraction, Unit = NRs2001/year

Variable

Potential Economic Effect= (1-XIDZ (1, "relative Insurgent/SF activity"*(1/State Capacity), 1) ^economic effect parameter)*economic effect switch Unit = Dmnl

Gap of Economic Effect= Potential Economic Effect-Economic Effect of Insurgency, Unit = Dmnl

Real GDP per capita= GDP at Insurgency/Total population, Unit = NRs2001/person

Loss of Nepal GDP= IF THEN ELSE (GDP at Insurgency growth rate>Normal GDP Growth Rate, 0, Normal GDP Growth Rate-GDP at Insurgency growth rate), Unit = NRs2001/year

Effective GDP Fraction= IF THEN ELSE (economic effect switch=1, gdp normal growth fraction*(1-Economic Effect of Insurgency), gdp normal growth fraction), Unit = Dmnl/year

gdp deflector = WITH LOOKUP (Time, ((1996,0)-(2015,500)), (1996,70.8979), (1997,76.0586), (1998,79.183), (1999,86.22), (2000,90.0762), (2001,100), (2002,103.935), (2003,107.126), (2004,111.589), (2005,118.418), (2006,127.14), (2007,136.807), (2008,144.495), (2009,167.482), (2010,192.85), (2011,212.977), (2012,231.599)), Unit = NRs/NRs2001

Additional SF expenditure= Security Force Additional*annual security expenditure per person, Unit = NRs/Month

"GDP growth rate %"= TREND (GDP at Insurgency, time horizon to measure growth rate, initial real GDP growth rate)*100. Unit = Dmnl/year

(Number of person could be converted to insurgents, if the condition is right).

Constant

Economic effect switch= 1, Unit = Dmnl

(1= economic effect of insurgency switch on; 0 = no economic effect of insurgency)

Economic effect parameter= 0.17, Unit = Dmnl

Time to adjust gap of economic effect= 3, Unit = year

Time horizon to measure growth rate= 1, Unit = year

Initial real GDP growth rate= 0.05328, Unit = Dmnl/year

Initial GDP per capita= 14891, Unit = NRs2001/person

Elasticity of State Capacity to recruitment= 0.5 Unit = Dmnl

GDP normal growth fraction= 0.062, Unit = Dmnl/year

(The average growth rate of nominal GDP based on the growth of 1991 to 1995 which was average 4.9%. The ninth and 10th plan fixed the target of 6% and 6.2% growth target in a

normal situation respectively. However, the Tenth plan fixed its target of 4.3% in high conflict scenario. If the situation is normal, Nepal could have been achieving its target. It is assumed normal growth rate during the simulation period is 6 %.)

Sector 4: Cost of Insurgency

Stock

Cantonment Cost= INTEG (Cantonment Cost Growth Rate, 0), Unit = NRs

After Insurgency Cost= INTEG (After Insurgency Cost Growth Rate-After Insurgency Cost Decrease Rate, 0), Unit = NRs

Total Cost of Insurgency= INTEG (Total Cost Growth Rate, 0), Unit = NRs

Flows

After Insurgency Cost Growth Rate= (Additional SF expenditure + Integration Cost of Insurgency into SF)*fraction of after insurgency cost, Unit = NRs/Month

After Insurgency Cost Decrease Rate= After Insurgency Cost/life time of after insurgency in effect, Unit = NRs/Month

Cantonment Cost Growth Rate= IF THEN ELSE (Time>=end of insurgency time: AND: Time<=integration time, number of insurgent in cantonment*expenditure per person per year in cantonment, 0) Unit =NRs/Month

Total Cost Growth Rate= Cost of Insurgency, Unit = NRs/Month

Variables

Maoist Voluntary Retirement Cost= IF THEN ELSE (Time=integration time, number of insurgent voluntarily retired*retirement cost per person, 0), Unit = NRs

Maoist Insurgent Expenditure= Weapon and Resource Growth Rate, Unit = NRs/year

(Initial resource is necessary for launching insurgency. it is assumed that insurgent should have sufficient resources and weapons to cover at least one year expenditure at the beginning. this figure comes insurgent number*required resources per person for six month)

Cost of Insurgency= (Additional SF expenditure + After Insurgency Cost + Cantonment Cost Growth Rate + Integration Cost of Insurgency into SF + Maoist Insurgent Expenditure + Maoist Voluntary Retirement Cost)/ (gdp deflector/100) + loss of Nepal GDP, Unit = NRs2001/year

Integration Cost of Insurgency into SF= IF THEN ELSE (Time>=integration time, number of Maoist integrated*annual security expenditure per person, 0), Unit = NRs/year

Cost of insurgency % of GDP= Cost of Insurgency/GDP at Insurgency*100 Unit = Dmnl/year

annual security expenditure per person= WITH LOOKUP (Time, ([(1996,0)-(2015,210000)], (1996,65500),(1997,60200),(1998,66700),(1999,76300),(2000,101000),(2001,125000),(2002,151000),(2003,146000),(2004,142000),(2005,151000),(2006,160000),(2007,186000),(2008,224000),(2009,241000),(2010,262000))), Unit = NRs/person/year

Constant

Number of insurgent voluntarily retired= 15610, Unit = person

Retirement cost per person= 700000, Unit = NRs/person

Fraction of after insurgency cost= 0.1, Unit = Dmnl/Month

Life time of after insurgency in effect= 30, Unit = Month

Expenditure per person per month in cantonment= 6000, Unit = NRs/person/Month

Number of insurgent in cantonment= 19602, Unit = person

Number of Maoist integrated= 1460, Unit = person

Integration time= 2012, Unit = year

(The integration process has concluded in Dec 2012 and 1460 combatants join Nepal Army in different rank and remaining were retired voluntarily by giving lump sum amount to them.)

Sector 5: State Capacity

Variables

State Capacity= IF THEN ELSE (switch state capacity=1, IF THEN ELSE (switch other indices=1, other indices*GDP Index , GDP Index), 1) Unit= Dmnl

Eff of State capacity on SF resources= 1-exp (-State Capacity ^SF resource parameter), Unit = Dmnl

Other indices= Civil Liberties Index*Employment Index*governance index*Literacy Index*Polity Index, Unit = Dmnl

Governance index= WITH LOOKUP (Time, ([(1996,0)-2015,2)], (1996,1), (1997,0.742386), (1998,0.742386), (1999,0.704315), (2000,0.704315), (2001,0.529188), (2002,0.529188), (2003,0.5), (2004,0.333756), (2005,0.335025), (2006,0.428934), (2007,0.465736), (2008,0.461929), (2009,0.440355), (2010,0.428934), (2011,0.431472))), Unit = Dmnl

Employment Index= WITH LOOKUP (Time,([(1996,0)-(2015,1.5)], (1996,1), (1997,1.0098), (1998,1.01961), (1999,1.03554), (2000,1.03064), (2001,1.01348), (2002,1.01716), (2003,1.01961), (2004,1.01716), (2005,1.0098), (2006,1.0049), (2007,1.00245), (2008,1.00613), (2009,1.00613), (2010,1.00735))), Unit = Dmnl

Literacy Index= WITH LOOKUP (Time, ([(1996, 0)-(2015, 5)], (1996, 1), (2001, 1.21434), (2009, 1.47739), (2010, 1.50662))), Unit = Dmnl

Civil Liberties Index= WITH LOOKUP (Time,([(1996,0)-(2015,2)], (1996,1), (1997,1), (1998,1), (1999,1), (2000,1), (2001,1), (2002,1), (2003,1), (2004,1.25), (2005,1.25), (2006,1), (2007,1), (2008,1), (2009,1), (2010,1), (2011,1), (2012,1))), Unit = Dmnl

GDP Index= real GDP per capita/initial GDP per capita, Unit = Dmnl

Polity Index= WITH LOOKUP (Time, ([(1996,0)-(2015,10)], (1996,1), (1997,1), (1998,1), (1999,1), (2000,1), (2001,1), (2002,1.33333), (2003,1.66667), (2004,1.66667), (2005,2), (2006,1.66667), (2007,1.66667), (2008,1.33333), (2009,1.33333), (2010,1.33333), (2011,1.33333), (2012,1.33333))), Unit = Dmnl

Constant

Switch other indices= 1, Unint = Dmnl

(1= consider the effect of economic, social, governance, and polity index, 0 = ignore the effect of economic, social, governance, and polity index)

Switch state capacity= 1, Unit = Dmnl

(1= consider state capacity in insurgency dynamism, 0= ignore state capacity)